FOURTEENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN,

FOR THE YEAR 1875.

BY AUTHORITY.

LANSING:
W. S. GEORGE & CO., STATE PRINTERS AND BINDERS.
1876.

State Board of Agriculture.

Members of State Board of Agriculture.

Hon. HEZEKIAH G. WELLS, of Kalamazoo,
PRESIDENT OF THE BOARD.

Hon. J. WEBSTER CHILDS, of Ypsilanti,
VICE PRESIDENT.

Hon. GEORGE W. PHILLIPS, of Romeo.

Hon. FRANKLIN WELLS, of Constantine.

Hon. A. S. DYCKMAN, of South Haven.

Hon. MILTON J. GARD, of Cassopolis.

JOHN J. BAGLEY, Governor of the State,
T. C. ABBOT, President Agricultural College, } *Ex Officio.*

ROBERT G. BAIRD, Secretary.
EPHRAIM LONGYEAR, of Lansing, Treasurer.

REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE.

AGRICULTURAL COLLEGE, *Lansing, December 27, 1875.*

TO JOHN J. BAGLEY, *Governor of the State of Michigan:*

I have the honor to submit herewith, to your Excellency, as required by statute, the accommpanying Report for the year 1875, with supplementary papers.

Respectfully yours,

ROBERT G. BAIRD,

Secretary of Michigan State Board of Agriculture.

COLLEGE ACCOUNTS.

SECRETARY'S ACCOUNT

For the Year from December 1st, 1874, to November 30th, 1875.

Dr.

To balance on hand December 1st, 1874		$2,033 48
Rec'd from State Treas. on acc't of interest	$14,413 72	
current expense	8,138 00	
library	500 00	
buildings and repairs	2,775 00	
museum	323 00	
stock, experiments, etc.	835 00	
chemical department	537 50	
steam works, furniture, etc.	1,000 00	
horticultural department	385 00	
bridge	800 00	
		29,707 22
Rec'd from farm department—receipts 1874 *	$449 76	
sale of land—T. Smith, 1874 *	70 00	
farm department—receipts 1875	4,649 48	
		5,169 24
Rec'd from horticultural department—receipts 1874 *	$278 80	
receipts	760 46	
boarding hall bill	74 57	
		1,113 83
Rec'd from farm house—board of employes		1,048 34
apiary receipts, 1874	$48 95	
1875	44 36	
		93 31
Rec'd from library receipts, 1874	$ 8 91	
1875	73 92	
		82 83
Rec'd from chemical laboratory (sale of steam coil)		22 63
boarding hall receipts, and board of employes		1,107 82
vacation account		52 07
Thomas Smith—payment on land		105 00
interest on land		39 53
part-payment on horse		75 00
students' indebtedness, 1874	698 82	
matriculation	435 00	
incidentals	828 25	
room rent	473 00	
chemicals	431 86	
board, washing, etc.	7,438 13	
		10,305 06
		$50,955 36

*These amounts appear in the statements of heads of departments for 1874, but were not received in time to appear in the Secretary's account. See Report for 1874, page 11.

CR.

By cash paid E. Longyear	$50,623 81	
balance on hand	331 55	
		$50,955 36

SUMMARY OF TREASURER'S ACCOUNT.

1874. DR.	
Dec 1.—To balance from old account	$2,751 86
1875.	
Nov. 30.—To cash at sundry times of Secretary and State Treasurer	50,623 81
Total	$53,375 67
1875. CR.	
Nov. 30.—By paid warrants	$53,115 97
By balance to new account	259 70
	$53,375 67
1875. DR.	
Dec. 1.—To balance from old account	$259 70

E. LONGYEAR, *Treasurer.*

I certify that the above is a true copy of the report of the Treasurer of the State Board of Agriculture, and that the original report is on file in my office.

R. G. BAIRD,
Secretary of State Board of Agriculture.

SUMMARY OF WARRANT ACCOUNT

For year ending November 30, 1875.

Expenses of State Board		$711 90
Salaries of officers		17,750 43
Horticultural department account, 1874	$278 80	
1875	2,023 62	
		2,302 42
Farm department account, 1874	$495 89	
1875	2,415 76	
		2,911 65
Farm-house		986 69

Boarding hall		$11,656 29*
Chemical department—apparatus	$642 24 + $131 68	773 92
chemicals		307 50
Library	$202 08	
"	286 58	
expense	5 90	
		494 56
Museum		359 91
Apiary, account of 1874	$48 95	
1875	27 29	
		76 24
Vacation account		1,329 11
New buildings		1,026 51
Improvement of buildings and grounds		140 04
Furniture and fixtures		38 75
Buildings and repairs		2,721 37
Steam works, furniture, and repairs		835 41
New bridge (over Cedar river)		800 00
Horse for boarding hall		150 00
Stock experiments, etc.		165 00
Secretary's office (books, stationery, postage, work, etc.)		218 63
President's " " " " "		72 72
Article on and map of peach regions		150 00
Advances refunded to students		793 59
Indebtedness		2,642 53
Extra work on new houses		1,056 72
Furnaces in "		435 17
Wells and pumps for new houses		160 60
Repairing new houses (damage by hailstorm)		41 20
Secretary's house		20 81
college hall		55 98
steps of Prof. Beal's house		9 13
cattle barn		1 25
and cleaning laboratory		21 33
Wood for laboratory		56 25
Oil, matches, etc., for laboratory		12 20
Stove and pipe for college hall		25 35
Wood for college hall		104 21
Oil and matches		8 60
Cleaning drain		2 25
President's office		2 50
Telegrams, boxing and expressage on reports, and postage on catalogues		127 23
Janitor's wages during vacation		106 25
Hack hire for committees, members of legislature, and officers visiting college		69 00
Ribbons for diplomas		4 75
Advertising college in various papers		98 50
Cuts for report and pamphlet on entomology		101 70
Insurance		50 00
Gardener's expenses from New York		24 90
Sunday services		75 00
Balance on apparatus, M. Miles		16 00
New mail-bag		6 50
Blank book and index		4 35
Map for catalogue		29 40
Grading in front of President's house		3 50
Freight on pipe and tile		2 11
Gate irons		10 75
Cards for labels		1 55
Erasers for blackboards		8 00

* It will be seen that there is a discrepancy between the receipts for board and disbursements for the same. The receipts here given are the actual amounts of cash received. The balance of board is paid by students' labor. The cash receipts and students' labor equal the disbursements and indebtedness of board.

Keep of horse at Constantine	$3 00	
Surveyor's chains	9 78	
State fair expenses, Gulley, Cook, and Garfield, and care of stock, etc.	83 11	
Expenses of President, to Ypsilanti $6 30, to Dearborn, $9 00, on college business	15 30	
Expenses of Secretary, settling bills and fare, to and from Dearborn	18 85	
Expenses of Prof. Beal, obtaining specimens for centennial	29 75	
Premium on gold to pay for pulper (Ontario)	5 81	
Board of gardener, foreman of farm and garden, assistant foreman of farm, and assistant on garden and green house	732 16	
		$53,065 97

NOTE.—It will be seen that there is a difference between the above account and the Treasurer's statement of warrants paid of $50. Warrant No. 2273, for $50, was drawn in October, 1874, and was included in Secretary's summary for that year. The Treasurer did not pay it until after December 1st, 1874, and it therefore appears in his account for this year. See Report for 1874, p. 13.

DEPARTMENT ACCOUNTS FOR THE YEAR.

FARM DEPARTMENT.

DR.

To disbursements on account of—		
stock	$115 05	
pigs	70 75	
office	27 37	
labor	1,013 23	
tools and implements	112 46	
repairs	65 09	
toll	4 26	
sheep	28 15	
teams	201 38	
lumber	19 76	
seeds	93 01	
fuel	25 68	
hardware	48 29	
wire for fences	6 01	
plaster, muck, etc.	29 33	
medicine	5 12	
traveling expenses	40 15	
board of employés	510 67	
	$2,415 76	
students' labor	2,103 84	
bills payable	287 73	

CR.

By receipts—		
bill of farm house		$150 61
sales of stock		2,037 70
use of stock		78 95
pigs		245 80
produce		955 20
wool		276 75
feed		12 15

labor		$42 85
implements		76
sheep		20 23
sale of team		155 00
students' labor		31 34
team account		24 26
wood		617 88
		$4,649 48
bills receivable		190 95
increase of inventory		648 73
Profit, $33 10, and increase of inventory, $648 73, to balance	681 83	
	$5,489 16	$5,489 16

HORTICULTURAL DEPARTMENT.

DR.

To disbursements—		
greenhouse	$790 36	
vegetable garden	111 44	
team	224 95	
labor	239 00	
tools, implements, and repairs	182 28	
office	11 31	
grounds	108 10	
nursery	3 90	
orchard	69 07	
manure	26 30	
board of teamster and extra man	256 91	
	$2,023 62	
students' labor	1,369 33	
bills payable	129 87	

CR.

By receipts—		
green-house		$367 77
vegetable garden		383 59
orchard		13 30
team		9 90
feed		9 25
labor		1 28
tools		8 71
lumber		90
payment on horse		40 33
		$835 03
bills receivable		149 48
increase in inventory		341 95
balance		2,196 36
	$3,522 82	$3,522 82

HORTICULTURAL DEPARTMENT.—CLASSIFICATION.

Green-house and flower beds.

DR.

To cash disbursements*	$790 36	
board of assistants	97 57	
students' labor	166 57	
team labor	74 10	
bills payable	12 36	
manure (three loads)	3 00	

*Two hundred dollars of these disbursements were paid for repairing damages inflicted by the great hail storm.

CR.

By plants and flowers sold		$366 77
given to S. B. of A.		46 85
increase in inventory		938 70
To increase to balance	$208 36	
	$1,352 32	$1,352 32

Vegetable Garden.

DR.

To cash disbursements	$111 44	
students' labor (including 1,087½ hours for drainage of new garden)	290 58	
team labor	86 40	
manure (193 loads)	193 00	
decrease in inventory	487 90	

CR.

By receipts		$383 59
bills receivable		69 83
decrease in inventory and improvement of ground to balance		715 90
	$1,169 32	$1,169 32

Grounds.

DR.

To cash disbursements	$108 10	
students' labor	609 88	
team labor	213 60	
manure (54 loads)	54 00	

CR.

By eight tons hay (sold team account)		$80 00
balance (expense)		905 58
	$985 58	$985 58

Barn.

DR.

To students' labor	$20 10	
team labor	27 90	

CR.

By improvements		$48 00
	$48 00	$48 00

Team and Teamster's Labor.

DR.

To cash disbursements	$463 95	
board of teamster	159 34	
team labor	11 40	
bills payable	30 15	
eight tons hay	80 00	

CR.

By receipts		$20 43
payment on horse		40 33
bills receivable		5 40
note for balance on horse		60 00
amount charged various departments		732 00
To decrease in inventory	146 40	
By balance		33 08
	$891 24	$891 24

Tools, Implements, and Repairs.

Dr.		
To cash disbursements	$182 28	
students' labor	68 21	
team labor	12 30	
bills payable	79 87	
Cr.		
By recipts		$9 61
increase in inventory		18 55
balance (expense)		314 50
	$342 66	$342 66

Office.

Dr.		
To cash disbursements	$11 31	
bills payable	99	
Cr.		
By increase in inventory		$19 00
To balance	6 70	
	$19 00	$19 00

Nursery.

Dr.		
To cash disbursements	$3 90	
students' labor	45 00	
team labor	6 00	
manure	1 00	
bills payable	2 25	
Cr.		
By balance (expense)		$58 18
	$58 18	$58 18

Orchard.

Dr.		
To cash disbursements	$69 07	
students' labor	52 96	
team labor	53 40	
manure	11 00	
Cr.		
By receipts		$13 30
balance (expense)		173 13
	$186 43	$186 43

Manure.

Dr.		
To cash disbursements	$26 30	
students' labor	55 44	
team labor	245 70	
bills payable	4 25	
Cr.		
By amount charged various departments		$262 00
balance		69 69
	$331 69	$331 69

General Account.

DR.

To students' labor on hall and houses	$24 04		
cellar	16 62		
State Fair	19 93		
		$60 59	
team labor, specimens for centennial		1 20	

CR.

By due from professors			$14 25
balance (expense)			47 54
		$61 79	$61 79

DEPARTMENT ACCOUNTS.

Farm House.

DR.

To cash disbursements	$986 69	
bills payable	87 29	

CR.

By board of foreman, superintendent, and employés of farm and garden, teamster, 344 6-7 weeks, at $3 04		$1,048 34
increase in inventory		25 64
	$1,073 98	$1,073 98

Chemical Department.

DR.

To cash disbursements	$642 24		
" "	131 68		
		$773 92	

CR.

By receipts (sale of coil)			$22 63
appropriation (State Legislature)			537 50
increase in inventory			501 12
To balance		287 33	
		$1,061 25	$1,061 25

Library.

DR.

To cash disbursements		$494 56	
students' labor		117 08	
bills payable	$4 25		
" "	13 75		
		18 00	

CR.

By receipts			$73 92
appropriation (State Legislature)			500 00
increase in inventory			571 74
To balance		516 02	
		$1,145 66	$1,145 66

Museum.

DR.

To cash disbursements	$359 91	
students' labor	28 97	
bills payable	114 00	

CR.

By appropriation (State Legislature)		$323 00
increase in inventory		639 05
To balance	$459 17	
	$962 05	$962 05

Apiary.

DR.

To cash disbursements	$27 29	
students' labor	33 79	

CR.

By receipts		$36 11
increase in inventory		19 83
balance		5 14
	$61 08	$61 08

STUDENTS' LABOR.

During the year the students have been credited with 47,978 hours' labor, amounting to $4,777 59. Of this sum $488 47 was paid for labor performed during the summer vacation, the rate per hour being 17½ cents. The average price per hour throughout the year (including vacation labor,) has been 9.995+ cts., and the amounts charged to different departments are as follows:

Farm department	$2,103 84	
Horticultural department, including care of grounds	1,369 16	
Permanent improvements	691 59	
Library	117 08	
Museum	28 97	
Apiary	33 79	
Secretary's office	28 28	
President's office	30 63	
Carrying mail	106 53	
Ringing bell	53 61	
Care of buildings	92 88	
Conducting visitors, collecting specimens, etc.	81 55	
Playing organ	27 13	
Extra work maps	12 55	
		$4,777 59

BOARD.

Students are furnished with board and washing at cost, and the receipts therefor add nothing to the actual income of the college. The average price of board throughout the year has been $2 76¼ per week. Washing, 42 cts. per dozen.

INVENTORY.

INVENTORY OF BUILDINGS.

College hall	$15,000 00	
Chemical laboratory	12,000 00	
New boarding hall	45,000 00	
Old boarding hall	15,000 00	
Farm house	3,500 00	
Three brick cottages	9,000 00	
One brick cottage	4,275 00	
Herdsman's cottage	600 00	
Six barns at Professors' houses	1,800 00	
New barn and shed, horticultural department	500 00	
Cattle barn and shed	3,200 00	
Sheep barn	2,500 00	
Horse barn	3,000 00	
Piggery	2,000 00	
Brick work shop	600 00	
Garden barn	600 00	
Blacksmith shop, tool house, feeding house, etc.	400 00	
Windmill and water supply	500 00	
Three new houses	20,718 00	
Green house	8,000 00	
Bee house	280 00	
		$148,473 00

INVENTORY OF FARM DEPARTMENT.

Reapers, mowers, plows, etc.		$1,528 00	
Hand implements		322 75	
Wagons, carts, sleighs, harness, etc.		475 60	
Scales		112 00	
Chains and hardware		51 80	
Carpenter's tools	$103 40		
Masons' tools	10 60		
Blacksmiths' tools	46 00		
		160 00	
Miscellaneous		247 90	
			2,898 05

Stock.

Short horn cattle, 18	$4,325 00	
Devon cattle, 9	900 00	
Ayrshire cattle, 14	2,100 00	
Galloway cattle, 4	450 00	
Jersey cattle, 3	400 00	
Hereford cattle, 1	100 00	
Grade cattle, 3	465 00	
		8,740 00

Sheep.

Merino, 17	$120 00	
Southdown, 19	198 00	
Highland, 4,	20 00	
Cotswold, 1 ram	50 00	
Grade, 77	385 00	
Culls, 7	9 50	
		782 50

Swine.

Berkshire, 7	$195 00	
Suffolk, 7	130 00	
Essex, 7	170 00	
		$495 00

Team.

Team horses, 4	$550 00	
One yoke oxen	165 00	
		715 00

Wood.

286⅛ cords	522 53

Compost.

1,500 cubic yards compost, 24 cts.	360 00

Office.

Furniture	154 40

Produce.

Wheat, 450 bushels, $1 20	$540 00	
Corn in crib, 1,265 bushels, 30 cts.	379 50	
Corn in piggery, 560 bushels, 15 cts.	84 00	
Oats 1,079 bushels (estimated), 30 cts.	323 70	
Oat straw, 15 tons, $4 00	60 00	
Wheat straw, 7 tons, $2 00	14 00	
Potatoes (rare varieties), 27 bushels, 62 1-27 cts.	16 75	
Potatoes (common varieties), 202⅔ bushels, 30 cts.	60 80	
Potatoes (small), 55 bushels, 15 cts.	8 25	
Roots, 8,960 bushels, 8 cts.	716 80	
Hay, 96½ tons, $8 00	772 00	
Corn stalks, 40 tons, $1 50	60 00	
Wool, 824¼ pounds, 40 cts.	329 70	
Miscellaneous	5 85	
		3,371 35
		$18,038 83

INVENTORY OF HORTICULTURAL DEPARTMENT.

Greenhouse.

Plants	$2,825 75		
Pots	25 00		
Furniture	40 00		
Coal	269 70		
Wood	75 00		
		$3,235 45	
Produce		209 60	
Teams		134 50	
Office		19 00	

Tools.

Carpenters'	$176 35		
Pruning	15 75		
Garden	626 90		
Masons'	7 75		
		826 75	
			$4,425 30

SUMMARY OF INVENTORY.

Farm, 676 acres, $70	$47,320 00
Buildings	148,473 00
Farm department	18,038 83
Horticultural department	4,425 30
Chemical department (apparatus and chemicals)	4,551 12
Library (books and periodicals)	7,414 34

Museum		$4,639 05
Apiary, bees, hives, tools, etc.		89 83
Boarding hall furniture, provisions, etc.		3,210 44
Farm house furniture, provision, etc.		721 39
Furniture and fixtures, college hall	$978 45	
Mathematical instruments, college hall	200 00	
		1,178 45
New bridge		800 00
		$240,861 75

INDEBTEDNESS OF COLLEGE.

Unpaid bills	$4,215 36	
Salaries due officers	2,435 33	
		$6,650 69
Less interest due from State Treasurer, 2 months	$1,600 00	
bills receivable	1,313 74	
cash on hand and in treasury	591 25	
due on land sold	800 00	
		4,304 99
		$2,345 70

INVENTORY ACCOUNT.

Property on hand, as per inventory, taken Dec. 1st, 1875	$240,861 75
" " " " " " 1st, 1874	231,407 87
Increase	$9,453 88

REPORTS OF DEPARTMENTS.

PRESIDENT'S REPORT FOR 1875.

As the Faculty make a report to the Board, and as each officer gives an account of what he has done in his department of labor, my report will relate chiefly to the work especially committed to me.

In the eighteen months since I returned to the college in May, 1874, I have been absent from college duty less than two weeks in all, inclusive of vacation. One of these weeks was spent with the legislature in their excursion to the Northern Peninsula.

The executive duties of the office of president, and its correspondence, are enough to tax the best abilities of one man, but I have shared in the burden of overwork which the poverty of the institution imposes on all its officers,—a burden complained of only that the multiplicity of duties impairs the quality of the work that is done.

In the class-room I have given the Seniors instruction in mental philosophy, in inductive logic, and in the constitution of the United States.

I have had charge of the daily chapel exercises, and of the Sunday afternoon services. The attention and decorum of the students during these exercises are in all respects as good as in churches anywhere. The Sunday afternoon services have been conducted as follows:

Feb. 28, by Rev. A. A. Knappen.
March 7, by Professor Fairchild.
March 14, by President Abbot.
March 21, by Rev. T. P. Prudden.
March 28, by President Abbot.
April 4, by President Abbot.
April 11, by President Abbot.
April 18, by Rev. D. Crosby.
April 25, by Rev. Weed (interrupted by fire).
May 2, by Rev. Weed.
May 9, by Rev. Augusta Chapin.
May 16, by Rev. C. R. Wilkins.
May 23, by Mr. Geo. C. Ewing, of Massachusetts.
May 30, by Rev. Mr. Prudden.
June 6, by Rev. Mr. Lanterman, of Paw Paw.
June 13, by President Abbot.
June 20, by Rev. Mr. Spencer.

June 27, by President Abbot.
July 18, by President Abbot.
July 25, by President Abbot.
Aug. 1, by Rev. Mr. Prudden (exchange).
Aug. 8, by Rev. Frank Russell, Kalamazoo.
Aug. 15, by Rev. N. Reasoner.
Aug. 22, by Rev. A. S. Kedzie, Dowagiac.
Aug. 29, by Rev. Mr. Prudden.
Sept. 5, by President Abbot.
Sept. 12, by President Abbot.
Sept. 19, by Rev. H. Banwell.
Sept. 26, by Rev. Chas. Simpson.
Oct. 3, by President Abbot.
Oct. 10, by Rev. Edward Ewing, of Massachusetts.
Oct. 17, by Prof. Fairchild.
Oct. 24, by Rev. E. Cooley, Jr.
Oct. 31, by President Abbot, Baccalaureate.

Clergymen whose residence is not given, were from the city of Lansing.

At the beginning of the college year, Dec. 1, 1874, I found myself on a committee to prepare the annual report of the Secretary of the State Board of Agriculture for 1873. After the completion of this report, I took upon myself to prepare the report for 1874, in advance of any authorization. I took to the printers the entire matter for 1873 except the meteorological tables, but inclusive of the reports of the State Agricultural Society and other societies, the 22d of January, 1875. The report for 1874, except the meteorological tables, I gave to the printers the 27th January, 1875. Much of the matter of this latter report was subsequently withdrawn, and handed to the Legislative committees on the College, by whom it was retained until after the close of the session, when it was returned to the printers.

As the printing of the reports was delayed, other matter was added to the report for 1874, in particular the addresses delivered by Dr. Kedzie and myself before the House of Representatives, at the request of that body, an article by Professor Cook on insects injurious to the farm, garden, and orchard; and an address on Manual Labor, delivered to the students of the College. The first copies of the reports for 1873 and 1874, bound in one volume, were received by us October 30th, 1875.

The College made an exhibition of stock, products of the vegetable garden, grasses, birds, and insects, at the State Fair. It made a collection of fruit for the National Pomological Society's meeting in Chicago, and is now engaged in collecting materials for the Centennial Exhibition in Philadelphia. Many of the officers have done work as members of bodies not connected with the College, but having somewhat similar objects in view. Lectures, papers, analyses have been made. I have requested the members of the faculty, in their reports, to give somewhat in detail these outside labors, as constituting a part of what the College is doing in its own legitimate sphere for the State.

The College is still subject to some debate as to its sphere of labor and future development. A few of its critics wish it to adhere strictly to what its name imports, and confine itself to agricultural teaching. Others say the Congressional grant was not made for agriculture alone, but for the mechanic and other industrial arts, and insist upon a change of name and an enlargement of the scope of the institution. It seems to me that the College has taken the right

ground,—a ground, by the way, prescribed by a State law, which no member of the Board or the Faculty had any hand in framing.

The requirements for admission are so low that the graduates of the common schools can enter; the course of study is sufficiently wide to develop a taste for reading in different lines of science, history, political economy, and philosophy; language is studied so as to impart accuracy and facility of expression,—powers essential to any general use of knowledge; the elements of those sciences which need to be understood as a basis for the study of agriculture and rural engineering are taught more thoroughly than in most other colleges.

Of course, the University and other colleges might impart this knowledge to our students; but only on the very unlikely condition that our students would first attend elsewhere, and the further condition of furnishing the requisite additional instructors, and means of illustration and practice. These would need to be,—books, perhaps, excepted,—about the same elsewhere as here. Our classes are full large for our instructor in each study, and could be added to no other college without a corresponding enlargement of the faculty. Working laboratories in chemistry, and other branches are full, and should be enlarged at the University or in this College, as students apply for room. Such enlargements and increase of instructors can be made as cheaply to the State here as elsewhere.

No colleges in the State have courses equivalent to our courses in agriculture, botany, horticulture, agricultural chemistry, meteorology, and entomology, while, by large modifications of many of the other studies, they are made to conform to and contribute to the main objects of the institution. Out of door instruction is constantly imparted in connection with the three hours daily manual labor required of all the students. The general character of the instruction, and the spirit of the place, is agricultural; all other studies are made subservient.

The name of the institution is of less account than the work it does. It is educating a class of farmers' sons who could not or would not go elsewhere. Although it exercises no censorship over their vocation, it returns to the farms as large a proportion, it is believed, of its graduates as the law schools of our country send into law offices, or medical schools into the practice of medicine, and forty per cent more than the other institutions of the land; and is doing this in spite of contrary customs, inherited through centuries.

The college needs enlargement. I believe the entire fund that shall be realized from the congressional grant is not more than sufficient for the support of one good agricultural school. Its agricultural library, its collections of animals, plants, and implements, its experiments, with additional professorships of stock-breeding, veterinary, chemistry, pomology, forestry, apiculture, physics, economic geology, rural engineering, landscape gardening, will more than absorb all funds it is ever likely to command.

Education in this line being new, and as a general thing undesired by the ones who ought to possess it, is the very reason why the college should be made able to render it attractive, thorough, and practical.

REPORT OF THE FACULTY.

STATE AGRICULTURAL COLLEGE,
Lansing, Mich., Dec. 1, 1875.

To the State Board of Agriculture:

The Faculty of the State Agricultural College respectfully submit their annual report as follows:

The whole number of students in the College during the year 1875 was 156, viz:

Resident Graduates	5	Freshmen	82
Seniors	16	Specials	11
Juniors	21		
Sophomores	21	Total	156

The average age of the students, by classes, was as follows:

Resident graduates	24 years	Seniors	19 years
Seniors	22 "	Freshmen	18 "
Juniors	19 "	Specials	19 "

The counties of the State were represented as follows:

Allegan	3	Lenawee	3
Barry	2	Livingston	2
Berrien	4	Macomb	1
Branch	1	Monroe	4
Calhoun	1	Newaygo	1
Cass	10	Oakland	12
Clinton	2	Ottawa	1
Eaton	2	Saginaw	3
Grand Traverse	7	Sanilac	2
Gratiot	2	Shiawassee	2
Hillsdale	6	St. Clair	1
Ingham	20	St. Joseph	11
Ionia	11	Van Buren	8
Jackson	4	Washtenaw	1
Kalamazoo	2	Wayne	7
Kent	8		
Lapeer	3	Total from the State	147

Other States than Michigan were represented thus:

Colorado	1	Indiana	5
Ohio	2	Denmark	1

Emmet Fuller, of the Senior Class, and William M. Royce, of the Freshman Class, were both removed by death while at their homes. They were both

excellent scholars, and much esteemed and beloved by their associates at the College.

At the beginning of the year the students, under the authority of the Faculty, formed an organization for self government. It consisted in the choice of a captain, a lieutenant, and a councilman for each of seven districts into which the two dormitories were divided. A limited power to make and enforce rules was delegated to these officers, subject to the supervision of the Faculty. The design of the organization was limited to the maintenance of good order in the dormitories. The organization has been of considerable service to the College.

The conduct of students has been good. There have been no cases of expulsion or suspension. The students have maintained their own societies, the Christian Union, and the Natural History Society, with interest throughout the year.

The Freshman class was so large that it was divided into two sections in nearly every study of the year.

Under authority given to President Abbot to provide for instruction additional to that given by the professors, the classes in History were put in charge of Mr. P. H. Felker, a resident graduate, who took them over ancient history and the middle ages in Freeman's Outlines, and gave a course of familiar lectures and readings illustrative of the lessons. In the same familiar way he discussed with the class the History of England to the reign of James III. and some prominent topics of early modern history.

Under the same arrangement, Mr. R. C. Carpenter, a graduate of the class of 1873, and of the Department of Civil Engineering in the University of Michigan, has given instruction throughout the year in mathematics, civil engineering, drawing, and astronomy. The report of his instruction is on file with the Secretary, and his name was placed in the catalogue as instructor. We are pleased with your late action appointing him instructor in mathematics and civil engineering.

The scheme of studies for the year past is given in the table below.

FIRST TERM.—BEGINNING FEBRUARY 24, 1875.

CLASS.	8 A. M.	9 A. M.	10 A. M.	11 A. M.
Seniors.......	Agriculture. Mental Philosophy.	....	Landscape Gardening 6 weeks. French.	Moral Philosophy 12 weeks. Political Economy.
Juniors	Drawing 6 weeks. Rhetoric.	Agricultural Chemistry.	....	Physiology 14 weeks. Entomology.
Sophomores..	Horticulture 8 weeks. Botany.	Geometry. Trigonometry.	....	Elementary Chemistry.
Freshmen	Rhetorical Praxis 6 weeks. History.	Book-Keeping 6 weeks, Physical Geography.	Algebra, A class.	Algebra, B class.

SECOND TERM.—BEGINNING JULY 12, 1875.

CLASS.	8 A. M.	9 A. M.	10 A. M.	11 A. M.
Seniors	Civil Engineering. Astronomy 6 weeks. Agriculture.	French.	....	Inductive Logic. U. S. Constitution.
Juniors	....	Entomology. Zoology. Geology.	Mechanics.	Chemical Physics. Meteorology.
Sophomores	Analytical Chemistry	Analytical Chemistry.	Analytical Chemistry.	Surveying 6 weeks. Rhetoric.
Freshmen	Practical Agriculture.	....	Algebra. Geometry B class. Botany A class. Praxis 4 weeks.	Botany, A class. Algebra, B class. Praxis 4 weeks.

All the classes have had regular exercises in compositions and declamations. The Senior and Junior classes have prepared original orations, and delivered them before the whole body of students.

Alternating with the orations of the Seniors and Juniors, addresses have been given to the students on Wednesday afternoons, as follows:

March 10.—Prof. Beal: Physical Culture.
April 7.—Pres. Abbot: Manners and Habits.
May 5.—Dr. Kedzie: The Soil.
May 19.—Prof. Cook: The Eye.
July 21.—Pres. Abbot: Manual Labor.
Aug. 4.—Dr. Kedzie: Character Developed by Difficulties.
Aug. 18.—Prof. Fairchild: The Poet's Place in the World's Workshop.
Sept. 1.—Prof. Cook: The Silk Worm and Silk Culture.
Sept. 22.—Prof. Beal: The Horticultural Department of the College; its Plans and Aims.
Oct. 6.—Hon. R. E. Trowbridge: Varied Industry the Policy of the Farmer.
Oct. 20. W. S. George, Esq.: The Almighty Dollar.

The instructions in practical agriculture met with some interruption, consequent on the resignation of Dr. Miles, the 24th of March. His instruction in the College for more than fourteen years has been marked by thoroughness, and by the interest it always awakened in the classes. We are sure it will be remembered with gratitude by all the students who have ever been under his charge, and we are glad he is to continue, even though no longer with us, his investigations and instructions in agriculture.

June 1, Mr. A. B. Gulley was appointed professor of agriculture in place of Dr. Miles, and at once entered upon duty, and has, so far as the time permitted, made up to the classes the instruction lost by the resignation of Dr. Miles.

Commencement exercises consisted of baccalaureate sermon by President Abbot, Nov. 7, and the class orations, and conferring degrees on commencement day, Nov. 10. The degree of Bachelor of Science was conferred on Oscar E. Angstman, Frank J. Annis, William L. Carpenter, Albert A. Crane, Charles Goodwin, Dean F. Griswold, Charles S. Ingersoll, Bartlett A. Nevins, Louis D. Niles, Charles H. Parker, DeWitt C. Postle, George A. Royce, Charles W. Sheldon, William A. Smith, and Charles A. Sturgis.

After the conferring of degrees, Governor Bagley, at the request of the President of the College, addressed the class most felicitously, both as to matter and manner. A short but important portion of the address was thus epitomized by the Flint Globe:

> "Perhaps the most notable feature of the occasion was the address of Governor Bagley, in which he told the young farmers that their education was given them by the State, not for their own personal and selfish ends, but as a trust to be used for the good of the community in which each one dwelt, and of the State at large. The added ability, capacity, usefulness, and manhood resulting to every young man going forth from college halls, is simply an investment made by the State,—capital lent,—and it was due to the State, not less than to the student's own self respect, that the interest should come back in the shape of better manhood, better private life, and better public service.
>
> "In speaking to the audience, he said that we, as a people, have got beyond grumbling over taxation for educational purposes. We have demonstrated that it pays to educate our children and our youths."

Each officer has given a detailed account of what has been done in his own department in reports now on file. The Faculty respectfully refer to these reports for further information regarding the instruction, the manual labor of the students, the management of the Farm and Horticultural Departments, the museums and library, and apiary.

It may be proper here to notice several organizations of the students. Prominent among these is the College Christian Union. It has sustained a vigorous Sunday school in the College chapel with the usual accompaniments of song, papers and books, and its privileges were shared by the households living at or near the College as well as by the students. A bible class in charge of Professor Fairchild, completed the study of the book of Job, another under Professor Cook, the book of Genesis. Other classes were in various books of the bible.

The union has sustained a weekly prayer meeting, which has been well attended, and has had the following Sunday evening lectures:

May 2.—By President Abbot: St. Anthony.

August 1.—By Rev. Wm. Wilkins: A Good Name above Riches.

August 22.—By Rev. T. P. Prudden: The Manly Tendencies of Christianity.

October 3.—By Prof. Fairchild: The Creed of the Atheist.

October 31.—By Mr. Chas. W. Garfield: Spiritual Forces.

The Union has given an entertainment every three weeks during the year, consisting of readings, short addresses and music. It has a valuable library, the use of which has been free to all the students.

The Society of Natural History has sustained its monthly meetings to the great profit of its members. The attendance upon these meetings has been large, and students have taken upon themselves to notice minutely and report carefully many curious natural phenomena. The collections of the Society and its library have been somewhat increased during the year.

The College Cadet Cornet Band and the military company, the Agricultural College Cadets, have added much to the pleasure of the students during the year.

The band and the Delta Tau Delta Society have each given a public entertainment in the College chapel.

The Board has recently made a change in the College terms and order of studies. The work of planning this arrangement and of presenting it to the Board was committed to Prof. Fairchild. The reasons for the change that weighed with the Faculty were, as presented by Prof. Fairchild to the Board, in brief as follows: A three term course suits better the length of time devoted to many of the studies; gives a natural division for settlements with students; puts Junior Exhibition with its interruption of the usual routine of duty at the close of a term; brings the first examination of the Freshmen, which is a sifting of the idle and incompetent, nearer the time of their entrance; gives students more frequent periods of absence for any duties away from College, and equalizes somewhat the burden of studies in the different terms.

Should it be practicable to bring our Commencement Season earlier in the year, this arrangement of terms might facilitate the change.

The scheme is as follows: The first term to commence the last Tuesday of February and continue thirteen weeks; then a recess of one week and a term of twelve weeks; then a recess of one week, followed by the third and last term of twelve weeks.

FRESHMEN STUDIES FOR EACH OF THREE TERMS.

1. Algebra, History, Composition.
2. Algebra, Botany, Agriculture.
3. Geometry, Botany, Bookkeeping, French.

SOPHMORES.

1. Geometry, Elementary Chemistry, French.
2. Trigonometry, Surveying, Organic Chemistry, French.
3. Mechanics, Analytical Chemistry.

JUNIORS.

1. Mechanics ½, Drawing ½, Agricultural Chemistry, Horticulture.
2. Entomology, Physics, Rhetoric.
3. Astronomy ½, Anatomy ½, Meteorology, English Literature.

SENIORS.

1. Physiology, Agriculture, Mental Philosophy.
2. Zoölogy, Geology, Botany ½, Constitution of the U. S., Moral Philosophy.
3. Civil Engineering, Political Economy, Landscape Gardening, Logic.

Some modifications of this course of study will be required for the higher classes, in order to adjust the present with the past order of studies.

Respectfully submitted,

T. C. ABBOT, *President.*

R. G. BAIRD, *Secretary.*

REPORT OF DEPARTMENT OF CHEMISTRY FOR 1875.

To the President of the State Agricultural College:

I herewith transmit to you a report of the condition of my department for the current year.

The year has been a very successful one, distinguished from many of the preceding years by a more uniform attendance on class exercises by the students. The total number of students who have received instructions in the Laboratory this year is 54, distributed as follows: in general chemistry, 29; chemical analysis and manipulation, 23; agricultural chemistry, 22; chemical physics and meteorology, 21.

During the first term in general chemistry I gave a full course of lectures with experimental illustrations, to the Sophomore Class and a few specials; also a full course of lectures, with experimental illustrations, to the Junior Class, in agricultural chemistry.

In the second term I gave a course of lectures on volumetric analysis to the Sophomore Class, and the class made thirty quantitative analyses by volume; also, to the same class a course of lectures on blowpipe analysis, and the class made fifteen analyses in determinative mineralogy; also a course of lectures on organic chemistry to the same class. This class had 100 bottles of separate substances for qualitative analysis in the wet way.

In the Junior Class, during the second term, I heard recitations in chemical physics, giving very full physical demonstrations of the properties of the "imponderable forces." I also gave a course of lectures on meteorology.

EXTRA CLASS WORK.

In addition to the required class exercises, I met the Sophomores one evening each week for a chemical conversation, in which the facts and principles of the science were reviewed, chiefly by questions from the students and answers by the teacher. I also met them every Saturday morning for two hours to give them practice in chemical manipulation. At this exercise the experiments were announced and apparatus furnished, but the student performed his own experiments. The students were greatly interested in this exercise, and although it was not a required exercise, it was very rare to find any one absent. I think this kind of instruction might with great profit to the students be extended and made more complete hereafter.

EXPENSES AND RECEIPTS.

The bill of chemicals purchased last June amounted to $307.50; the receipts of chemicals furnished to the students in chemical analysis amounted to $430, showing an excess of receipts above expenses of more than $120. The cost of chemicals is an expense which is a serious burden to most of our students. While I think the students should pay the full cost of what they use, I do not think the College should make a pecuniary profit therefrom. I think the advanced fee for the student in analysis should be reduced from $15 to $12. It may be that it may, in the future, be still more reduced; but I am sure that it is safe to make this reduction now.

NEW APPARATUS.

Out of last year's appropriation there were purchased last spring an anemometer, with self-recording apparatus, wind vane, Green's Standard Barometer and Rainguage, at a total cost of about $125. These instruments were obtained through the Signal Service Bureau, and are the same as are used in the U. S. Signal Service. They are very satisfactory in their working.

Out of the appropriation of last winter, apparatus has been purchased to the amount of $658.38. By a mistake in my estimate of money available to meet this account, the bill exceeded the available means by $106. This sum I advanced, waiting for means which will become available next year to reimburse me. The apparatus is of superior quality, and was greatly needed in this department.

FURNACE.

I have obtained a new furnace for the laboratory at a cost of about $180. The maker of the furnace, F. J. Buck, of Adrian, agrees to wait for his pay till March, 1876. The furnace was furnished at a large reduction from retail price. It works very satisfactorily.

TEXT BOOKS IN CHEMICAL ANALYSIS.

During the spring term I re-wrote my hand-book of chemical analysis, making many improvements and numerous additions. This hand-book has been used as a text book in five Agricultural colleges besides our own. An edition of 250 volumes has been printed for the use of classes in this College.

METEOROLOGICAL OBSERVATIONS.

A full set of meteorological observations has been taken during the year. These observations have now been taken continuously for more than twelve years. They have been regularly furnished to the Smithsonian Institution, and are used by the Secretary of State, and Secretary of State Board of Health in preparing their annual reports.

ASSISTANT IN CHEMISTRY.

I cannot in justice pass from the subject of laboratory work, without speaking of the satisfactory way in which my assistant has performed his duties. Besides the janitor work for the laboratory, sweeping the rooms, building fires, etc., work usually done by a student specially assigned for that duty, he assists in preparing chemical and apparatus for class room illustration. He takes all the meteorological observations. When I am absent from the College, still more important duties devolve upon him. When I have been called away from my classes for work in other fields, he has delivered my lectures in chemistry, and taken entire charge of class in chemical analysis, and the classes seem to be entirely satisfied with this arrangement. While he has discharged these difficult duties with entire satisfaction, his salary is less than that of any employé of the College that fills a position of like responsibility. While other employés receive $600, with board, washing, and other personal expenses, amounting to at least $4 per week, he receives only $600, with no cost to the College for personal expenses. He thus receives a salary of $400 as compared with the salaries of other employés. At some future day I shall ask to have his salary placed on a par with other employés of the College. He is now at the Sheffield Scientific School of Yale College, to fit himself more fully for his duties at this College.

GENERAL WORK.

A good deal of work has been done for the public outside of my regular class room work. Numerous analyses of substances for the benefit of farmers, and in advancing the cause of public health, have been made at this College. Much of my spare time has been occupied in an elaborate investigation of the influence of Paris green when applied to destroy the potato beetle. It may seem that this work belongs more properly to the State Board of Health than to the Agricultural College. It is true that this work was undertaken for the State Board of Health, and for the American Public Health Association (in which I was appointed a member of a committee on "the use of Poisons in Agriculture"). But when we consider that prominent scientific men at the east have publicly charged that the application of Paris green to the potato crop would poison the soil so that wheat raised on such soil would contain arsenic, and thus be unfit for human food, and when we realize how easily an alarm of this kind might extend to the old world, and drive American wheat from the world's market, we see it is of the highest importance to the farmer to have this question settled, and settled in such a way as will not leave his grain to rot in his barns for want of a market.

SANITARY INSPECTION.

During the vacation last fall, at the request of the Board of Commissioners of Penal, Pauper and Reformatory Institutions, I visited the State School at Coldwater, the State Prison at Jackson, the House of Correction in Detroit, the Asylum for the Deaf and Dumb, and the Blind at Flint, and the Reform School in Lansing, making a thorough inspection of their sanitary condition in regard to ventilation, sewerage, heating, and water-supply; and made a full report to the Secretary of that Board. This report was published in full in the Report of the Secretary of the State Board of Health for 1874.

This tour of sanitary inspection, and the preparation of the report, consumed nearly a month of the vacation. It was disagreeable and thankless work, but it may yet bear fruit in ameliorating the condition of the helpless and pauper classes contained in our public institutions, as well as those confined for crime.

PUBLIC LECTURES.

I have given five public lectures during the year: a lecture before the House of Representatives "on the relations of Chemistry to the public health and to agriculture;" an address to the students of the State University at their Medical Commencement; an address as President of the State Medical Society, on Ozone; a lecture on "The Soil," and another on "The influence of difficulties in stimulating the pursuit of knowledge," both of these before the students and faculty of this college.

Respectfully submitted,

R. C. KEDZIE,
Professor of Chemistry.

REPORT OF THE PROFESSOR OF ENGLISH LITERATURE.

MICHIGAN STATE AGRICULTURAL COLLEGE,
November 26, 1875.

To the President of the College:

DEAR SIR:—Herewith is presented a report of the duties and the accomplishment in my department during the college year just closing. The usual routine has been departed from by a change in the course of study by which Rhetoric precedes English Literature, and prepares the way for greater advancement in the latter study. This change has necessitated two classes in Rhetoric with none in Literature.

The Junior class had a course of eleven weeks in Whately's Rhetoric, taking all of *conviction* and *persuasion*, and select portions of *style*. The attention and diligence shown by the majority of the class were excellent. The class began with twenty members, but lost two by excuse from college. The remaining eighteen passed a satisfactory examination at the close of the first term, June 22d.

The Sophomore class took up Hepburn's Rhetoric on August 23d, and continued the study for eleven weeks. The entire book was passed over in recitation, and the most of it was reviewed before the final examination, November 9th. This class numbered twenty, of whom two took honorable dismission from college before the close of the term, one was absent for sickness, and one failed to pass. The remaining sixteen attained a satisfactory standing and passed the required examination. The new text-book was found, with a class of such advancement in the course, not so satisfactory as was expected. By especial effort to give abundance of familiar illustration in the class-room its too concise form was made less objectionable, and the interest of the class seemed not to flag in the least.

The senior class had the usual courses of twenty-six weeks in French, using Otto's Grammar and Reader, as edited by Prof. Bôcher. The first course of ten weeks was devoted to Part 1st of the Grammar, with written themes daily in review, and closed with an examination June 21st. All but one of the seventeen members showed a passable progress. The second course of sixteen weeks embraced a short stay upon irregular verbs and idiomatic expressions with written themes, and other daily lessons in the reader with attendant grammar lessons till Part 2d of the Grammar was completed, and some fifty pages of the reader were translated and reviewed. The class also followed the teacher in an easy translation of a comedy found in their reader, and were thus aided in familiarizing corresponding idioms of French and English. All of the members, sixteen in number, finished the course with a creditable examination, October 29th.

The senior class completed Fairchild's moral philosophy, and reviewed most of it in the twelve weeks ending May 21st. The class of fifteen members was reduced to fourteen by the death of one of its best scholars, Mr. Emmet Fuller. All of the fourteen passed the required examination.

The very brief course in political economy is made more complete by being given in the form of twenty five lectures with reviews. A full list of the topics presented in order and dependence, was kept before the class by chart, while my

own collection of standard authors in this field, was placed in the public library for the use of the students. The seventeen students who completed this course, passed a fair examination on June 18th.

The rhetorical exercises of the Senior and Junior classes, under my charge, have required the oversight in preparation and delivery of 144 orations, of which fifteen were for Commencement and nineteen for Junior exhibition. Most of the year the Juniors have had class exercises once in two weeks taken up with essays, select readings or declamations, and familiar lectures on oratory, gestures, and elocution in general. The amount of time and care involved in these exercises is appreciable by those only whose similar duties have taught them. Every monthly oration has been carefully revised (all criticisms being explained to the author in private), and then twice rehearsed to me before final delivery. For public occasions a written analysis of each oration is required before its preparation, and at least four rehearsals precede its delivery. Only the interest and advancement of the students is a real compensation for such work.

Full reports of standing in all these classes, absences, examinations, and topics of examinations, are already on file with the Secretary of the College.

A voluntary class in Shakespeare, made up mostly of Juniors, was organized early in the year, and has had an average attendance of about fifteen. Three plays have been read and commented upon: The Merchant of Venice, Taming of a Shrew, and Hamlet. The hour from seven to eight of each Thursday evening was taken for this exercise.

Of the two public lectures that should have fallen to me, one was crowded out by the number of orations required in the early part of the year, the other was delivered in the regular routine, as given in the Faculty's report.

The general oversight of the library and reading room, gives a set of duties somewhat varied, of which a separate report is rendered.

Other duties in College routine have been of a miscellaneous character, mostly in form of committee work. They embrace general arrangements for Commencement and Junior Exhibition, revision and adjustment of schemes for class exercises, adaptation and promotion of the system of student government, devising and adjusting the new arrangement of studies in three terms, and the revision and publication of the annual catalogue. This last work grew by one suggestion after another till almost an entirely new form was given to the matter descriptive of the course of study and our facilities for instruction. A chart of the grounds after a drawing by Mr. R. C. Carpenter, added much to the effect of the work. A well and a barn have been constructed near my dwelling with my plans and supervision.

Associated intimately with the general welfare is the work of the College Christian Union. Some of my energies have been demanded for this in teaching a large Bible class through the year, giving one of the monthly Sunday evening lectures and two less formal addresses, and rendering some service in the purchase of books. I have also given two sermons in the regular Sabbath services at the College.

Of work outside the College limits little has been possible. I have delivered elsewhere two lectures in aid of general education, and two sermons. The office of Township Superintendent of Schools was almost forced upon me, and I have spent in its duties at odd hours and on Saturdays some ten days' time,—so little that I am ashamed to speak of it. My absence from College duties during the year has been limited to seven days, during which provision was made for my classes through the kindness of President Abbot and Mr. Carpenter.

The year, upon the whole, has been a satisfactory one, and I find myself less worn than sometimes at the close of a year, because of a more equal distribution of its cares through its different parts. That its duties are yet very confining and include too broad a field of study for the best of work, will not be denied by any who have had experience in such departments. That this multiplicity of cares may appear, must be my apology for any apparent minuteness of detail.

Respectfully submitted,

GEO. T. FAIRCHILD.

REPORT OF LIBRARIAN.

MICHIGAN STATE AGRICULTURAL COLLEGE,
Lansing, November 30, 1875.

To the President of the College:

DEAR SIR,—The following is a report of the work, use, and condition of the College Library for the year this day closed:

The Library has been open daily during term time, on Sunday from 10 A. M. to 12 M., on Saturday from 3 to 6 P. M., and on other days from 4 to 6 P. M. While open it has been, as usual, under the care of a student assigned to that duty. This duty has been satisfactorily performed.

At the beginning of the year it was found possible to undertake the work of renewing the catalogue of authors upon the card system, by which the place occupied by each book on the shelves is found in an alphabetical list of the authors, with the titles of their works. This involved a reärranging, labelling, classifying, and marking for cases, of the entire library. The work was done under my direction by a half-dozen of the Seniors in the first six weeks of the year, and the result has been a great convenience already to the librarian and assistant. A check list of books in the cases most in use has also been completed, and found useful. This catalogue thus far extends only over bound volumes. Some progress was made in a catalogue of pamphlets; but for want of suitable cases, no arrangement for easy reference could be devised, and the work was postponed. The pamphlets have been classified somewhat, and tied in bundles, with a list of contents upon each.

The filing of newspapers has been made more complete than ever before. Each year's issue of every paper has been tied by itself with a list of missing numbers, if any, attached, while a full list of the contents of each file has been fastened to the whole. Several of the most complete have been put in cases, where they can be reached for reference. The files of the Lansing Republican, the Wolverine Citizen, and the Michigan Argus, run back with considerable fullness to the opening of the College, in 1857.

A full record of books drawn and returned has been attempted by a system of checks posted to individual accounts with those using the library. Only a few cases of failure to make the needed record have come to my knowledge, and those were the result of carelessness or thoughtlessness. The freedom allowed

the students in use of the books for constant reference in the library, while a great advantage to them, gives room for carelessness.

The record thus kept shows the use made of the books, aside from the frequent references in the library, which are more numerous from the fact that all cyclopedias and works of general reference are of *class first,* not to be drawn by students. The whole number of volumes drawn was 1,236, of which 275 were in the sciences, 142 in history and biography, 109 in agriculture and horticulture, and the remainder in miscellaneous literature, including bound volumes of periodicals. The whole number of persons using the library was 164, and the number of books drawn by each varies from one to forty, averaging a little less than nine. The above does not include the use made of the Christian Union library deposited with the college, and consisting of about 150 volumes, which have circulated very actively.

Donations to the library have been duly recorded and their receipt acknowledged to the donor, a written report being presented to the faculty monthly.

The additions to the library have been mostly by donations. The greater part of $500 00 appropriated for its increase necessarily took the place of portions of other appropriations not available till 1876. This sum refunded, with $500 00 added from the appropriation for 1876, will bring a noticeable increase. A list is already in preparation for purchase before the opening of the next term.

The purchases this year, aside from those ordered last year and named in the report of 1874, have been—

Johnson's How Crops Feed.
Allen's New American Farm Book.
Darwin's Insectivorous Plants.
The Circle of the Sciences, 2 vols. (by exchange).

The number of volumes added by all purchases is 47. Donations already reported to the Faculty have added 102 bound volumes and 28 valuable pamphlets, and 10 volumes have come through the exchanges of the Secretary of the State Board of Agriculture. Periodicals put in substantial binding give 55 volumes more, making the total increase:

Bound volumes	214
Pamphlets	28

The above does not include some fifty catalogues of books, seeds, implements, stock, etc., for sale. Volumes to the number of 41, from duplicates and a residue of old text-books, have been sold, so that the actual increase in numbers is about 200.

The desks have been well supplied with periodicals, largely by kindness of publishers. The following 24 have been taken by the College upon subscription:

The American Agriculturist.
The American Chemist.
The American Naturalist.
The American Journal of Science.
The American Bee Journal.
The Chemical News.
The Country Gentleman.
The Canadian Entomologist.
The Gardener's Chronicle.
The Journal of the Chemical Society.
Nature.
The Atlantic Monthly.

Blackwood's Magazine.
Harper's Monthly.
The North American Review.
The International Review.
The British Quarterly Review.
The Edinburgh Review.
The London Quarterly Review.
The Westminster Review.
The Nation.
The New England Journal of Education.
The Detroit Daily Tribune.
The Detroit Daily Post.

Nearly 50 periodicals of various kinds have been furnished regularly by the publishers; most of them throughout the year. They are as follows:

The Prairie Farmer.
The Western Rural.
The Western Agriculturist.
Scientific Farmer.
The New England Farmer.
The Canada Farmer.
The American Farmer.
The American Rural Home.
The American Patron.
The New Era and Northern Granger.
The Boston Journal of Chemistry.
The Detroit Review of Medicine.
The Peninsular Journal of Medicine.
The Essex Institute Bulletin.
The Patent Office Gazette.
Monthly Reports of Department of Agriculture.
Michigan Legislative Journal.
The Bee-Keepers' Magazine.
Gleanings in Bee-Culture.
Moon's Bee World.
The Michigan Teacher.
The Galaxy.
The Penn Monthly.
The American Missionary.
The Church Union.
The Advent Review.
The Health Reformer.

Also the following Michigan Newspapers:

Ann Arbor Michigan Argus.
Charlotte Republican.
Coldwater Republican, semi-weekly.
Flint Wolverine Citizen.
Grand Haven Herald.
Grand Rapids Saturday Evening Post.
Grand Rapids Times.
Greenville Independent.
Hastings Republican Banner.

Hudson Post.
Ingham County News.
Lansing Journal.
Lansing Republican, semi-weekly.
Midland Independent.
Midland Times.
Newaygo Tribune.
Pontiac Bill-Poster.
Sanilac Jeffersonian.
Sturgis Journal and Times.
Traverse Bay Eagle.
Romeo Observer.
Williamston Enterprise.
Ypsilanti Commercial.
From the American Unitarian Association have come:
The Religious Magazine.
The Christian Register.

President Abbot has furnished regularly The Detroit Daily Free Press, The New York Evening Post, semi-weekly, the Weekly Scotsman, and The School.

Prof. Beal has furnished The Cassopolis Vigilant, and occasional numbers of other papers.

Mr. C. W. Garfield has contributed The Weekly Free Press.

The Librarian has added the Michigan Farmer, Harper's Weekly, Oberlin Weekly News, The American Citizen, The Advance, and St. Nicholas for six months.

The whole number of different periodicals thus placed on our tables is 88. What use is made of these can best be judged by the numbers who have frequented the Library for reading.

The general attractiveness of the Library has been increased by a fine map of the College farm, prepared by Mr. R. C. Carpenter, instructor; by a curious representation of ancient plowing, an impression of sculpture taken from a tomb in Egypt by Mr. H. G. Reynolds, of class '70; and by the collection of the Natural History Society.

Expenditures under my direction have amounted to $498.81. Add to this printing and stationery in general bill of the College, $13.75, and 1,205 hours' labor of students, $117.08, and the total expenditure (including unpaid bills in the hands of the Secretary, $13.75 and $4.25) is $629.64, distributed as follows:

Books for library		$185 99
Periodicals, not paid in 1874		39 31
Binding (1874)		137 25
Binding (1875) 83 Vols. @ $1.25	$103 75	
2 " repaired @ 50c	1 00	
		104 75
Express charges		2 95
Postage and exchange		3 72
Printing and stationery:		
3000 cards for catalogues	$8 00	
4000 labels and checks	5 00	
blank-books	2 40	
paper, pens, ink, gum, tacks	3 77	
		19 17

Students' labor	$117 08
Books resold	19 42
Total	$629 64

Cash receipts paid the Secretary are:

From text-books	$21 00
duplicates, etc.	32 75
books resold	20 17

The text-books are Prof. Kedzie's Manual of Analytical Chemistry, deposited for sale with the librarian, but not charged to the library.

Deducting from the total, $629.64, the library receipts proper, $52.92, we have the actual expense, $576.72, most of which was anticipated at the close of last year, and provided for out of the balance in the Library Fund.

For the exact condition of the Library Fund, I may refer to the financial report of the Secretary of the College.

The library now contains in round numbers 3,700 volumes, besides newspaper files; and its value, by very low estimate, is placed at $7,414 34.

It is hoped that next year we may be enabled to add effectively to the books of most frequent use, to perfect the catalogue of authors by adding the pamphlets as arranged in cases to be provided, and to prepare convenient lists of the titles most frequently needed.

Respectfully submitted,

GEO. T. FAIRCHILD, *Librarian.*

REPORT OF THE CURATOR OF THE MUSEUM.

AGRICULTURAL COLLEGE,
Lansing, Michigan, November 20, 1875.

To the President of the College:

As Curator of the general Museum, I make the following report:

ZOOLOGICAL MUSEUM.

This branch of the Museum has made substantial growth during the year, by the purchase of a large number of fine specimens, which was authorized by the present Legislature, pursuant to a recommendation of the Board. These specimens have been catalogued and placed on exhibition.

MINERALOGICAL COLLECTION.

A very valuable acquisition to this part of our Museum has been made through the kindness of Mr. P. W. Norris, of Norris, Wayne Co., who has donated a large number of fine specimens collected in Colorado, the College paying the expense of transportation These specimens collected by Mr. Norris are not yet put on exhibition, owing to want of room.

PALEONTOLOGY.

Our store of fossils, through the kindness of Hon. S. O. Knapp, R. C. Kedzie, and several of the students, has been considerably enlarged. These specimens have been catalogued and placed on exhibition.

ARCHÆOLOGY.

For the first time our Museum has taken a start in this direction. The class of '78 has given attention to this department, and have already made quite a collection. This has also received substantial aid through donations from Profs. Kedzie and Cook. These specimens have all been catalogued and placed on exhibition.

Our faunal collection in entomology has been put in cases with glass fronts and suspended in the class-room for more convenient study. This proves to be an improvement of which general advantage is taken.

In compliance with instructions from the State Board of Agriculture, I prepared a collection of mammals, birds, and insects, for exhibition at the State Fair. The arrangement was made with reference to the use and habits of the various animals, and seemed to attract very general attention throughout the entire time of the fair.

A paramount need in the Museum is more room. This question of room is one that very soon should occupy the attention of the Board. If some other place could be found for the models in the room east of the Museum, it occurs to me that it would be well to take a part or the whole of that room and devote it to the uses of the general Museum.

The following is an account of the expenses incurred in the care, management, and improvements made for the year:

Students' labor, making stands	$22 00
" " care of Museum	8 97
Freight and express	6 25
Lumber for stands, etc.	3 55
Specimens purchased, eggs and silk moth	1 50
Implements and preservatives	7 73
Total expenses	$47 50

INVENTORY.

Estimated valuation at the beginning of the year	$4,000 00
Added by purchase specimens, valued at	321 50
New stands, etc.	24 55
Donations, Indian relics, fossils, minerals, etc.	40 00
	$4,386 05

A. J. COOK.

REPORT OF THE PROFESSOR OF BOTANY AND HORTICULTURE.

To the President of the State Agricultural College:

I present the following report of my department for the year 1875:

LANDSCAPE GARDENING.

The usual course of six weeks was devoted to the above subject by the members of the Senior Class, consisting of fifteen students. The instruction acquired by the text book and by lectures is much assisted by the illustrations on the College grounds. Frequent visits and references were made to different parts of the premises to study the different sorts of ornamental trees and shrubs, singly and in groups. Certain features of the paths, drives, lawns, flower-beds, location and style of the buildings, served as important additional illustrations. This course, aided by the previous practice during work hours, made it possible to fix the principles of this beautiful art in much shorter time and in a more lasting manner than would otherwise be possible. Every dollar thus spent in improving our buildings and in other ways ornamenting our grounds, is adding so much to what may be called "apparatus." It is not only a good investment to assist the teaching of our students, but in all who visit the College it stimulates a taste for rural life which cannot help yielding good results.

HORTICULTURE.

At the beginning of the year the Juniors, twenty-one in number, devoted eight weeks to horticulture. The time has always seemed too short for this important study. By the recent change in the course adopted by the State Board of Agriculture, the time is lengthened to thirteen weeks and placed at the beginning of the Junior year. As the Juniors occupy the entire year working in the Horticultural Department, the teaching will now come in just the right place, preceding the practice.

Much of the instruction was given by lectures, and, as in landscape gardening, frequent visits and references were made to the College orchards, gardens, and green-house. The chief topics considered in the course were as follows:

Location of the garden; preparation of soil, grading, draining, laying out, sowing seeds, irrigation, modes of culture, mulching.

Tools—care, structure, uses. Construction, composition, management of the compost heap; application of all kinds of fertilizers; rotation of crops; remedies for insects, thieves; construction, management, and use of hot-beds, cold frames, green-houses; transplanting, harvesting, marketing, packing, shipping, storing. Special crops—onions, celery, cabbages, squashes, tomatoes, etc., etc. Market garden; seed growing; double cropping; protection; profits; overdoing; frequent changing; experiments. New kinds—how obtained by cross-breeding; how to begin.

Propagation of fruit and ornamental trees, shrubs and herbs, by grafting, budding, layering, cuttings. Best sites for orchards; kinds to set out, and why; constant care in culture, pruning, killing insects, thinning, harvesting; fruit-houses, cellars, drying.

Modes and means of classifying fruits by form, color, size, taste, twigs, leaves, flowers, and seeds.

Best management,—distance of planting, training, soils, etc., for each common large and small fruit.

STUDENTS' LABOR.

Except the employment of a gardener, a foreman, and a teamster, all the manual labor in the Horticultural Department is performed by students. The raising of students' wages for regular work to a maximum of ten cents per hour, has had an excellent effect in stimulating them to greater exertion.

Our students work as well as they study, and generally better. A failure to receive the highest wages is usually more keenly felt than a failure to receive the highest marks for recitations and examinations. For want of a mechanic to attend to repairs and improvements of buildings, there is a constant temptation to keep at such work, a few students who are handy with tools. To the disadvantage of the work, we frequently change students from one kind of work to another, that we may serve all alike, and give all a variety. Three students, one at a time, have had charge of the garden tools and workshop. The tools are all numbered or lettered, and each has its place on or near a corresponding number. At a quarter to one, students report for work in a special suit of clothes suitable for garden work. They are assigned to work, and select their tools, which are charged to them in a book by the student in care of the tools, and when through work at four o'clock, and the tools are cleaned and put in place, the number is checked off the book.

One student collects and distributes fruit and vegetables at the Professors' houses and the boarding hall. Another drives the cart horse for a month or so. The juniors alternate, two or more at a time, in working six weeks or more in the green-house and on the flower beds. As the garden work is so varied in character, and a little at a time in so many different places, we have for several years generally divided the students into small companies, putting the work in charge of a senior or junior, who acts as a sort of sub foreman over the freshmen. The superintendent and foreman take in charge some special job of importance, or one of them visits and advises the several groups of students. It may be of interest to pass in review what all the students were doing in the horticultural department on three days selected from our work book.

On April 15th a gang of five Juniors, with the foreman, were pruning apple trees; six were raking leaves on the lawn, and trimming borders of drives; three hoed the ridges away from small trees in the nursery; three worked in the green-house; two ground tools; three sowed onions; one showed visitors about; two cared for the College chapel and recitation rooms; four loaded clay on wagons to put in the bottom of flower beds.

On July 15th the work book shows the following distribution of students: Ten raked and hoed over about half of the vegetable garden; one put Paris green on potatoes; two rubbed sprouts from apple trees; two picked peas; one delivered vegetables; two worked in green-house; one looked after tools; one run the lawn mower; two put in a brick partition in the seed loft; four helped get up hay on the lawn; one showed visitors about; the rest worked on the drives.

On September 20th four students picked apples; two worked at green-house; three dug experimental potatoes; five dug muck for compost heap; one cared for tools; twelve worked on the drains in new vegetable garden; six shoveled

gravel for drives; two worked on a gutter by a drive; three worked on a vegetable cellar; one cared for College hall.

BOTANY.

After leaving horticulture, the Sophomores resumed botany for ten weeks. The course consisted largely in lectures, with some study of *Gray's Structural and Systematic Botany*, and considerable study of specimens. Five days were given to the principles of classification, including nomenclature. Five days were given to the study of ornamental plants, including those of the greenhouse; one day to the movements of plants, as in sleep, climbing, carnivorous habits, etc.; one day to the eminent botanists; one day to mosses and liverworts; five days to *Fungi*, as to mode of growth, effect on the air, colors, odors, taste, fertilization, classification, as a cause of disease or a consequence of it, uses, distinguishing poisons from edible, geographical distribution, some special or peculiar kinds, as in mildew, mould, must, smut, rust, bunt, brand, as causing potato rot, mildew of grapes, etc., as found in the interior of living animals. Three days were given to *algæ* or sea-weeds; two days to geographical botany; one day to *gymnosperms* (pines, spruces, cycæs); three days to our native trees, with reference to their culture and uses; one day to the distribution of seeds; one day to the fertilization of plants, as aided by insects, wind, water, etc.; five days to the grasses; five days to ferns and their allies; ten days to other natural orders of most use to the farmer and gardener, as the Leguminosæ, Rosaceæ, Cruciferæ, Solanaceæ, Umbelliferæ, Compositæ, Labiateæ.

At the opening of the second term the Freshmen began physiological and morphological botany. Owing to the unusual size of the class this year, it was necessary to meet the students in two divisions an hour each, daily. The entire number was seventy-one. The first lessons were to study a pea-plant flower, then leaves, fruit, etc. Other plants were taken in the same way. Students were required to collect and study so as to be able to state in their own words the structure and other peculiarities of the plant. Some assistance was given in the class. After a few weeks books were used. In analyzing plants, they proceeded more slowly and thoroughly than is the usual custom. Our motto is, "not how many plants can you find the name of, but how well do you know those you study?" For the best results, the classes were too large. A more satisfactory mode would be to have smaller classes, and have them spend a longer time each day, somewhat as they do in analytical chemistry. Many members of the class become excellent observers, but some of them were too young to grasp well the ideas of morphology and microscopic structure. There seemed no way to show the slides under the compound microscopes, except to put them in the hands of two members of the class and station them in the hall or another room apart from the recitation room. Three special written examinations were had besides one at the close of the term. This enabled me to mark each student as though he were called up to recite forty times in eighteen weeks.

The following are lists of questions for the year, which were submitted at the close of each subject or term for a written examination:

QUESTIONS IN BOTANY.

First examination: two hours given for writing answers.

1. How can we learn the shape of cells?
2. What is cell multiplication?

3. What are the peculiarities of cells of pine wood?
4. What is woody tissue, and where found?
5. What are air passages, and where found?
6. What is chlorophyll, and where found?
7. The difference between roots and stems of exogens?
8. What is the plan of vegetation in the higher plants?
9. What is meant by indefinite annual growth? Give examples.
10. Give the morphology of tendrils.
11. Name and define four kinds of underground stems.
12. What are the points of resemblance between exogenous and endogenous wood?
13. What is the structure and place of medullary rays?
14. What are panicled leaves? Give examples.
15. Name and define three ways that leaves are arranged in the bud.
16. Structure, position, number, and use of stomata?
17. Early condition of leaves in the bud?
18. Name three very diverse styles of leaves which are called parallel veined.
19. Name several diverse forms of stipules.
20. How does a raceme answer to an umbel?
21. Define the pattern flower.
22. Describe an anatropous ovule.
23. What is a capsule? Give two examples.
24. What is the morphology of a fig?
25. Name two seeds with and two without albumen.

Second examination in botany. Time given, two hours:

1. What are varieties, and how are they propagated? Ten examples.
2. What are races, and how propagated? Ten examples.
3. What are natural orders? Name ten.
4. Name and define the classes as taught.
5. Name two botanical characters of high value and two of low value.
6. What is the name of a plant? Who invented the present mode of naming, and what are its advantages?
7. What are synonyms, and how do they arise?
8. Difference betwween the natural system and an artificial one?
9. What can you say of the movement of any twining plant and tendril?
10. The relations of insects, as now understood, to the flowers and leaves of the pitcher plant?
11. Name and give the country of five prominent botanists not now living, and something they were noted for.
12. State the agency of insects in fertilizing some three species of plants?
12. What is dimorphism?
14. Dichagamy?
15. Define ferns, including mode of fertilization.
16. Describe some fungus, its mode of growth, etc.
17. Name three prominent points about geographical botany.
18. Define the grasses, and state their relative value.
19. Name five of the most useful native trees for timber and five for ornament.
20. Give characters of *Leguminosæ* and state for what the order is remarkable.

For some years it has been customary for the Royal Agricultural Society of

6

England to examine candidates for the society's prizes and certificates, including the life membership of the society. The sets of questions are upon mechanics and natural philosophy, mensuration and surveying, chemistry, agriculture, book-keeping, geology, botany, anatomy, and animal physiology.

It may be interesting to insert here the questions on botany for 1875. Maximum number of marks, 100; pass number, 50; time allowed, three hours.

1. What are the contents of a growing vegetable cell?
2. Describe the composition of a fibro-vascular bundle in a dicotyledonous plant.
3. Name and shortly describe the different kinds of roots, and explain the function of fleshy roots.
4. What is the nature and cause of the difference between grain and malt?
5. Explain the fall of the leaf.
6. What are the morphological differences between the fleshy organs of the following plants: turnip, potato, onion, kohlrabi, sweet potato, and crocus?
7. Give the plan of a typical flower, and explain the meaning of perfect, complete, regular, and symmetrical, as applied to the flower.
8. Explain the process of fertilization among angiosperms.
9. State the nature and development of the reproductive organs in fungi.
10. What are the reasons for having a rotation of crops?
11. Give the leading characters of one of the following natural orders: *Ranuncalaceæ, Compositæ, Coniferæ, Gramineæ.*
12. Describe in systematic method the plants marked A, B, and C.

QUESTIONS IN HORTICULTURE.

Time, one hour and a half.

1. Location, situation, and laying out of a vegetable garden.
2. Management and application of barnyard manure to a garden.
3. Construction and management of cold-frames.
4. Construction and management of hot-beds.
5. Give a list of common tender plants of vegetable garden (as regards cold).
6. Planting and management of asparagus.
7. How to raise good celery cheapest.
8. How are peaches, apples, grapes, quinces usually propagated, and at what time of year?
9. Best situations for peaches in Michigan, and why?
10. How to properly set an apple tree.
11. How to properly prune an apple tree, young and old.
12. Best remedies for the apple worm.
13. Name the chief points by which varieties of apples can be distinguished by tree, fruit, and flower.
14. What are the chief difficulties in raising pears?
15. How are peaches classified?
16. How to plant and manage a strawberry bed for choice fruit?
17. Advice to beginners in market gardening.
18. Culture of market and small fruit garden.

LANDSCAPE GARDENING.

Time, two hours.

1. Choice of a place; fifteen prominent considerations.

2. What to avoid in the management of a place; fifteen prominent considerations.
3. Compactness, with illustrations.
4. Gradation.
5. How to increase the apparent extent of a place.
6. How to get a variety; five important points.
7. Three rules for arranging trees.
8. The formal style and where most suitable.
9. Give ten good shapes for formal flower beds.
10. Adaptation, with examples.
11. Economy in the management of a place; five requisites.
12. Chief rules for locating walks and drives.
13. Name ten nice evergreens well adapted to our climate.
14. Positions suited to rustic objects.
15. Rules for constructing mounds and banks.
16. Leading points as to size, shape of carriage-sweeps.
17. Advantages and disadvantages of many evergreens.
18. Chief rules for constructing walks and drives after they are located.
19. Errors likely to occur in sodding a lawn.
20. Advantages of a curvilinear roof for a green-house.

THE MUSEUM

of plant products has received almost no additions on account of extra work in teaching and other duties demanding time. The collections we possess have been of much service for class purposes. Large additions could be easily made if we had a little time and more room. They would be among the greatest attractions at the College.

THE CENTENNIAL EXPOSITION.

So far as practicable, duplicate specimens are secured for the College Museum while making collections for the world's fair. This may largely add to our woods, seeds, etc.

THE STATE FAIR.

In accordance with an invitation of the State Agricultural Society, and a resolution of the State Board of Agriculture, my department made a partial exhibit of its products at the State Fair, including over thirty species of the more prominent grasses and forage plants, about twenty-five varieties of gourds and squashes, seventeen sorts of beets, ten of carrots, four of parsnips, six of peppers, twenty of cucumbers, twelve of sweet herbs, vegetable snails, peanuts, other curiosities, two hundred and forty varieties of potatoes; about seventy-five of our worst sorts of weeds growing in pots, a banana in fruit, and many other miscellaneous articles. For the arrangement, quality, variety, and accurate naming, this display called forth much commendation from the crowds of visitors and members of the press. For a fuller notice see Secretary Kimball's report. With more means, and less of other things to do, we can, no doubt, another year far exceed this display in every respect. Most of my

LAST REPORT

was published in about 150 papers, including the leading newspapers of our State, some of other States, nearly all the leading agricultural papers of the northern States. This was done by sending advanced sheets, a little at a time.

By this means the matter was read by many more people than would otherwise be possible. This plan has been very highly spoken of by the press, by his Excellency, Governor Bagley, and by many private parties, "as just the plan," "an admirable idea," "a sensible thing to do," and many other similar expressions of approval.

OUTSIDE WORK.

Although the duties of my professorship are by no means "a mere sinecure," it has seemed necessary for success to spend some time in mingling with the outside world and to take part in various associations by papers and discussions. Many invitations for speaking and writing have been declined. The writer has aided the College Natural History Society as its president, by frequent remarks and by encouraging the students to take part. Public lectures have been given at the College to all the students and Faculty on "Physical Culture" and "The Horticultural Department;" one at the State Teachers' Association on "Teaching Natural History;" one at the Ingham County Teachers' Association on the same topic. One evening was spent with the Farmers' Club at Lenawee Junction, in a talk on "Grasses," "Trimming Apple Trees," "Orchard Insects," and in answering questions. One evening was spent in a similar way at Lambertville, Monroe Co. At the State Pomological Society held at Ionia I gave an address on "How Plants Grow;" at Lansing on "Trimming Trees;" at Monroe on "Fungi." The writer attended the American Pomological Society held at Chicago, where he took an extensive collection of fruits from Ingham and surrounding counties. At the American Association for the Advancement of Science, held in Detroit, he read three papers on "Inequilateral Leaves," "Venation of some Odd Leaves," and "Carnivorous Plants." A fourth paper was accepted but the writer was unable to remain for the time set apart to read it. A few articles have been given to the Michigan Teacher, American Naturalist, Country Gentleman, Michigan Farmer, Prairie Farmer, Annual of Rural Affairs, Science, Gossip, etc. Several weeks, besides a very large correspondence, have been spent collecting and preparing timber and various forest products for the Centennial.

TOOL SHED AND SEED LOFT.

The past summer we have built the shed so long needed for the larger tools. It is placed southeast of the garden barn and near it. The entire new building is 50 by 25 feet. The lower part is used for tools. A closet four feet wide across the east end, serves the teamster a useful purpose as a safe place to lock up some of the more valuable tools. The upper story is divided into two equal portions; one joined to the chamber of the old barn is used to increase the room for hay from the lawn; the other half is approached by stairs at the east end, and is used for storing and cleaning seeds, and the like. It is not yet all finished inside, but is already a great convenience.

THE GREEN-HOUSE.

The number of visitors continues unabated. Last spring a severe hail storm, some of the stones of which were over three inches long, beat out some 800 panes of glass. This made a large additional expense on the green-house, for which there was no provision made. The gardener has made two trips to Milwaukee, Chicago, and other western towns, where he has at a small expense added largely to our collection of plants. We have received a few from Wash-

ington; a few have been purchased. We now have about 555 species and varieties, many of them very choice and some of them rare. A small store room has been built, ten feet square, back of the green-house for boxes, soil, moss, etc. The sales at the green-house could easily be increased by finishing the propagating pits, or by converting the present houses into a commercial establishment. The latter would not be in accordance with the design of the house. It is now serving a very useful purpose for instruction in botany and horticulture. Students every day, at all times of day, when not in classes or at work, are seen loitering about the green-house, to study the century plant, cacti, night blooming cereus, palms, tree ferns, cycas, banana, tea, coffee, India rubber, euphorbiæ, nepenthes (a queer tropical pitcher plant), acacias, begonias, coccolobia, or some other new and curious or common plant referred to in the lecture room. They are amused and instructed; they are refined by the influence of the beautiful plants, well kept in the beautiful green-house. It is certainly a great satisfaction to have such an attraction at the College, and a greater satisfaction to have it for illustration and experiment.

The flower beds are still quite limited in extent. They have been much improved by digging out, to the depth of two feet, the poor sandy soil, and filling in with rich loam, clay and manure.

THE LAWN

by the green-house and elsewhere has been considerably improved by grading and enriching the soil. There is a vast amount of work still needed in this direction. There is scarcely a square rod of lawns or drives in a condition satisfactory to the one in charge. He does the best he can with his limited means. There has been but little done on the drives for want of means. A few stone gutters, a little sodding, a little gravel added here and there, is about all. A few trees have been added. Those previously planted have been well cared for, and with few exceptions have done well. The farm department needed all their mowers when we needed one on the lawn. Our old Buckeye was used up. We purchased a light Champion mower, of Warder, Mitchell & Co., of Ohio. We were delighted with its use in all respects. The purchase of a new mower was not allowed in the estimates a year ago. The account of the Secretary shows a good deal of students' labor on the "care of grounds." This includes the keeping in order—in but poor order I am bound to say—the drives, paths, care of shade trees, picking up about buildings, cutting and getting in the hay from the lawn, etc., etc. There is a good deal of ground to go over, including, when all done, over two and three-fourths ($2\frac{3}{4}$) miles in length of drives and paths.

TEAM.

One of the horses in our garden team had become unfit for hard work, the other was getting old. It was thought best to sell one at a hundred dollars, and turn the other over to the farm for breeding. This involved some extra expense in the purchase of a new younger team. This necessary change is another not provided for in estimates last winter. Our old cart horse, "Old Prof," is still very good, though slow. He is twenty-five years old this season, and came here soon after the College opened.

FORESTRY AND NURSERY.

This has all been put together in a strip next the road, north of the houses occupied by Dr. Kedzie and Prof. Fairchild. The patch contains long rows of

young forest trees, growing from seed, as black walnut, white ash, sugar maple, hickory, chestnut, white wood, and others, and a smaller quantity of many others which are not likely to prove of so much use for timber or ornament. It also includes a good variety of young plants for samples of hedges, and quite a lot of evergreens and other ornamental stock, samples of many of the rarer shrubs of other parts of the country, also some which grew from seeds obtained from the Kew gardens. It also includes a small quantity of young apple trees.

THE VEGETABLE GARDEN AND SMALL FRUITS.

The yield and quality of most varieties have been better than common. The young currant bushes have borne well and made a nice growth. They are planted four feet apart each way, and have always been kept heavily mulched with coarse litter. They now nearly cover the ground. In the spring we shall extend the patch to one-fifth acre. The worm has not troubled the College currants this season, although they have now for two years worked on the bushes near the houses of two professors. We have Red Dutch, White Dutch, Cherry, Victoria, Versailles, White Grape. The new asparagus bed has been considerably enlarged, and will be still more next spring. Of strawberries, we raise about twenty sorts: Wilson and Green Prolific for main crop, so far, in mixed rows. In small quantity we have Charles Downing, Jucunda, Triomphe DeGand, French, Emperor, Agriculturist, Downer's, Metcalf, Philadelphia, Wilder. Of the last list named I have nothing much to say on our sandy loam. The Green Prolific yields better than Wilson; Colonel Cheeney has done nicely; Michigan very promising; also Kentucky for late.

CLOSETS.

Several closets at the Agricultural College are built on ground slightly sloping, with the back side toward the foot of the slope. No pits or holes are dug. Along the back side are doors turned down horizontally and hung on hinges by the upper edge. The doors usually hang down to the ground, but may be easily raised to remove night soil when necessary. A small room in the same building is filled, in dry time, with dry muck, loam, or dust from the road. Clay is better than sand. Every day, or every other day, or twice a day, a small quantity is shoveled into each closet. Copperas-water, lime, plaster, or other deodorizers, are also used in addition to dry earth. Every few weeks, or even once or twice a year for a small family, the night soil is carted away to the compost heap.

If cared for as above there is almost no unpleasant odor; nor is it more disagreeable to cart away than so much manure from a barnyard. The advantages of some such mode are: The closets may be cheaply made and kept nearly free from unpleasant odor; they may consequently be placed much nearer the house, or even connected with it; there is no pestilential filth filtering into adjacent wells, or otherwise causing "mysterious epidemics" in the family; the compost heap is increased in value. Something like this, or better than this, must some day become the universal custom in all the best private houses, schools, railway depots, and hotels.

Slops from the kitchen can be run upon a heap of dirt which may be occasionally shoveled over and changed after it has absorbed a good deal of filth. It is then well worth removing to use as a fertilizer. It is better than running underground into a pit where the odors generally find some way of escape, often into the kitchen, on account of some defect or stoppage of the pipes.

The use of dry earth is vastly better than to wash the filth into a sewer,

thence into a river to contaminate the air and water. A little mouse, a dead frog or squirrel, or a few dead worms, will spoil the water of a well so everyone will smell it and refuse to drink it. The same subjects are completely deodorized by a small shovelful of dry earth.

OUR COMPOST HEAP.

The position of the main compost heap has been removed to the south of the barn and privy, and near both these buildings. We have another pile started near the new vegetable garden. They are constructed on the same plan as last year, which suited us so well. We believe a plenty of manure is a good thing for the farmer and gardener to have, that most of them cannot succeed without it, that nearly all can very easily increase the quantity and value two fold or more. We prefer to use on the garden manure that is well rotted or decomposed. The place for the compost heap is made nearly flat, but a little highest around the edges. On the bottom is placed a layer of muck, six inches or a foot in thickness. In all the management of manure, we have constantly in mind the high price of labor of men and teams, and the cheapness of various kinds of farm and garden produce. The muck is drawn but a short distance,—forty rods, perhaps. To economize team work, we use two wagons, having one loaded while the other is on the road. Carts with wide tires are better. The muck is taken from the flats to the yard and leveled a little after it leaves the dump boards. This first layer usually remains several weeks in the early part of summer until it becomes pretty well dried out. The kind we use at present, and like very much, is taken from the flats of a brook where it is covered with a very tough sod of sedges and grasses. The sods we cut out with very sharp spades, and use, of course, with the rest of the muck. The muck is black and loamy, such as would produce a bountiful crop of grass every season after good drainage. On the bottom layer of muck, after drying out, we place a layer of manure of equal thickness with the muck. Then another layer of muck, and usually wait awhile for it to dry out, if it had not been dried out at the muck bed. The latter we should always do, if we had far to haul the muck. The manure we get is furnished by our horse-barn, where are kept four horses, by the privies well supplied with dry earth, by purchase or gift of parties in Lansing, three miles away, or elsewhere. We like to draw it in summer, because then the roads are best, the manure is dry and light so we can draw twice as much in value as during spring or autumn when we have to draw much water which is to be had at home without price. Manure is more easily obtained at this season. We cannot always get it in winter. Besides, we can then mix it with muck, and manure composted in August, or earlier, is in good condition for use by next spring; while, if we draw it in winter, or later, it is often not in good condition till summer. We draw all the manure we can find time to, preferring, for our sandy soil, to use half muck to half manure, instead of clear horse manure. The muck, alternating with the manure, prevents it from burning out and wasting. Again, the use of muck saves much hand labor of turning the manure to prevent overheating. So highly do I value something for this purpose, and as an absorbant, I would use good soil if I could not get muck, and poor soil if I could not get good soil.

By the middle of September we want the heap six or eight feet high, keeping the top flat or a trifle dishing. Perhaps it is not as good for the heap, but to save labor we drive onto it with teams to unload. We add tops of potatoes, tomatoes, and any similar refuse, except weeds which may contain seeds. The

better the feed given to animals the better the manure. We do not judge of its value by its looks. That made from animals fed on straw and marsh hay (sedges), may be some better rotted and look well, but it is much less desirable than that which comes from a livery stable, where the horses have plenty of grain.

In the fall or winter or spring, whenever we have help to best advantage, the whole pile is turned once or more. In spring we shall probably have 400 loads of fine manure for the horticultural department,—manure suitable for any crop, flower bed, or lawn. We like to have a large pile of muck dried and under shelter, to use about the dung heap in winter. Our plan of managing a compost heap is about the same as employed on the farm proper. On August 30 the farm compost heap was 60 by 72 feet and eight feet high, well packed down by horses and cart. The two piles for the horticultural department are about as large, though not yet quite so high.

Thus far in the vegetable garden we have only attempted to raise summer vegetables enough for the farm house and boarding hall. We have raised too many varieties for profit. Next season we intend to make the experimental plats and all the sample beds in a part of the old vegetable garden east of the greenhouse. Three and a half acres near the houses of the Professors have been set apart, at present, for an enlargement of the garden for vegetables and small fruits. It has been well ditched four feet deep; some of it graded and all plowed. On this large piece we intend to raise onions, raspberries, strawberries, and some other stuff. This will demand some extra work, but the increased quantity of produce will pay for the extra work.

CULTURE AND WEEDS.

We believe in thorough culture, and act out our belief. The garden is all worked over about once in five days. The soil is light, so rains do not interfere, except for a few hours. Weeds are watched very carefully by passing over the ground after cultivating, raking, or hoeing. We know how long it takes to go over an acre of clean garden, or one where the weeds are only pricking out of the soil. We have not tried the experiment of one patch in weeds hoed once in two or three weeks, and the other of equal size kept clean by working the soil every four or six days, but according to estimate the cheapest way is to cultivate often. It doesn't require *one-fourth* the labor to go over a garden with a steel-toothed rake or hand-weeder often, as above stated, as it does to weed several times during the season after weeds get up six inches or more in height. Aside from the smaller amount and ease of the work, the increased yield, quality, and earliness of the produce are all on the side of thorough culture. It seldom pays to keep a garden hoed only once in three weeks; it nearly always pays well if thoroughly tilled. The ground is kept perfectly clean after the crop is taken off, so the soil is not getting filled with seeds. It is a very common error with farmers or gardeners to leave the garden or field until the weeds make a show, instead of going over the ground often.

Since preparing the above, several months ago, I find "a practical hint on weeds" in the Country Gentleman, evidently from J. J. Thomas, who is ever making apt contrasts between the best and the poorest way of doing things. By his watch, a bed of flowers containing 80 square feet is raked once a week in four minutes for each raking, and for May, June, and July, 48 minutes. In another bed of equal size it required over an hour to clear all out by hoe and hand. This must be repeated every three weeks for three or four months,

requiring half a day's work to keep the weeds under for three months, and even then doing it imperfectly.

It is a little difficult, at first, to make the students work the ground all over thoroughly if they can see no weeds. However, they do prefer working a clean garden to one filled with weeds two to six inches high. A single season of this practice generally convinces them all that it is the cheapest way and that it brings the most profit.

We cultivate mostly with a horse one way, making the rows long and straight. The students' work in the garden is mostly done with a steel-toothed rake and hand cultivators. We take great pains to remove any pigweed, purslanes, etc., which may have escaped previous notice. They contain seeds in immense numbers before many people are aware of it. One of the students last season estimated that a large, well-grown plant of purslane contained 1,250,000 seeds. The ground is carefully freed from weeds till winter. None are allowed to seed the ground. They appear now to be running out.

NOTES ON ONIONS.

A row ten feet long of each sort was planted on sandy, leechy soil, all treated alike. Harvested when cold weather came:

	Weight.			
Naseby's Gray Mammoth, poor and unripe	9	lbs.	10	ozs.
White Globe, mature	10	"	10	"
Early Red Globe, mature, nice	12	"	12	"
Giant Rocca, immature, uneven	15	"	5	"
Improved Large Yellow Cracker, mature, medium	8	"	9	"
New Queen, early, amount to little	..	"	12	"
White Flat Italian, very early	6	"	8	"
Early Flat Red	7	"	3	"
Southport Late Globe, good size, not mature	14	"	14	"
Yellow Strasburgh	12	"	14	"
Marzajole, one half scullions	3	"	11	"
Large Round Giant Maderia, large, immature	15	"	14	"
White Portugal, white pink stripe, pretty	8	"	8	"
Yellow Danvers, mature	11	"	6	"

Red Wethersfield, not all mature, good yield.

The quality was not tested.

EXPERIMENTS WITH POTATOES.

No.	PLAN OF PROCEDURE.	Size.	Number.	No. Hills.	Lbs.	Per Hill.
1	Planted on surface	Large.	Many.	12	51½	4 7-25
2	Planted ½ foot deep	Largest.	Medium.	11	52	4 8-11
3	Planted 1 foot deep	Large.	Medium.	10	28	2 4-5
4	Planted in ridge 6 inches high	Variable.	Medium.	10	32½	3¼
5	Planted seed end of tuber	Large.	Medium.	9	37	4 1-9
6	Planted opposite end	Medium.	Few.	9	33	3⅔
7	Planted, pruned as last year	Small.	Few.	11	27½	2 15-22
8	Ordinary culture	Medium.	Medium.	10	40	4

In the plat pruned there was cut irregularly about one-third of the tops at three different times.

In the experimental garden the lots are all labeled as planted; a plat of the whole garden is drawed off in a book. The labels and book are both consulted at the end of the season, when the crops are harvested, measured, or weighed.

The soil is light sand, with leechy bottom, naturally poor, but made very fair in quality by manuring for about ten years with crops every year. *Superphosphate*, purchased of Jarvis & Hooker, at Detroit, was put on alternate sections of ten hills each, with the following results: The dressing consisted in putting a tablespoonful in each hill (two feet apart)—rows about three feet apart; and then forking the soil and superphosphate thoroughly together, just before dropping one-third of a medium tuber in each hill. So far as we know they were all treated precisely alike.

In these four columns the plats were in juxtaposition, which are here placed side by side.

BRESEE'S KING OF EARLIES.		EARLY SHAW.	
With Dressing.	Without Dressing.	With Dressing.	Without Dressing.
22.50 lbs.	29 lbs.	12 lbs.	14 lbs.
18.20 "	18.20 "	12.75 "	15.25 "
22.50 "	17.20 "	12.75 "	12.50 "
12.25 "	20.25 "	12.75 "	12.75 "
18 "	18 "	9.50 "	12 "
		6.50 "	8.75 "
93.45 lbs.	102.65 lbs.	5.20 "	6.75 "
		18 "	20 "
		18.50 "	23 "
		16.50 "	20.75 "
		18.25 "	21.25 "
		20.50 "	23.75 "
		23.50 "	21.50 "
		20.75 "	24 "
		18 "	21 "
		225.45 lbs.	253.25 lbs.

The results, favoring no use of superphosphate, may be owing to an improper mixing in the soil.

TRIMMING POTATOES.

A single experiment last year with Campbell's Late Rose showed an increased yield where the tops were about one-third cut off at three different times during the growing season. A row of Peerless potatoes was divided into six equal parts of 23 hills each. Alternate parts were trimmed three times, as above stated, otherwise they were treated alike.

Trimmed, 23 hills yield	51 13-16 lbs.
" 23 " "	45 5-16 "
" 23 " "	40 4-16 "
	137 6-16 lbs.
23 hills not trimmed yield	59 13-16 lbs.
23 " "	64 13-16 "
23 " "	51 13-16 "
	176 7-16 "

This season, with our soil and treatment, it did not seem best to trim Peerless potatoes.

EARLY ROSE.

25 hills trimmed as above yield	55	lbs.
25 " " "	77 8-16	"
25 " " "	57 3-16	"
	189 11-16	"
25 hills not trimmed yield	72 6-16	lbs.
25 " "	98	"
25 " "	67 1-16	"
	237 7-16	"

This season, with our soil and treatment, it did not seem best to trim Early Rose potatoes.

CAMPBELL'S LATE ROSE.

25 hills trimmed as above yield	30 2-16	lbs.
25 " " "	28 4-16	"
25 " " "	31 7-16	"
	89 13-16	"
25 hills not trimmed yield	52 4-16	lbs.
25 " "	33 14-16	"
25 " "	31 14-16	"
	118	"

The experiments in trimming Campbell's Late Rose potatoes give a result very much like that of Peerless and Early Rose,—not favorable to trimming.

COMPARATIVE YIELD OF MANY SORTS.

A moderate sized tuber was cut in three pieces, and one piece used for a hill. All were treated alike on soil apparently quite even, of rather poor sandy loam:

NAME.	YIELD.		NAME.	YIELD.	
Early White	21 lbs.	1 oz.	Early Pinkeye	9 lbs.	10 oz.
Early York	16	7	De Bliss	9	8
Early Favorite	15	13	Harrison	9	8
Carpenter's Seedling	15	4	Dover	9	7
Pond's Seedling	15	3	Union	9	7
Early Goodrich	13	8	Early California	9	6
White Rose	12	2	Extra Early White	9	6
Red Jacket	11	6	Red Streak	9	5
Seedling Mercer	11	6	Early Prince	9	5
Ice Cream	11	5	Bulkley	9	4
Minnesota Seedling	11	--	Buckeye	9	3
Early Vermont	10	14	White Mountain	8	14
Early White	10	14	New Kidney	8	14
Great Britain	10	14	Strawberry	8	12
Elder	10	10	Prairie Flower	8	12
Bradford's Seedling	10	6	Early Snowball	8	11
" Hillard	10	4	Peerless	8	11
Dana's Seedling	10	2	Snowflake	8	11
Alpha	10	2	Early Samaritan	8	10
Breesee's Prolific	10	1	Climax	8	8
British Queen	9	14	Hampshire Seedling	8	8

NAME.	YIELD.	
Kansas	8 lbs.	5 oz.
Davis	8	4
Early Manley	8	3
Napoleon	8	2
Alaska Blue	8	2
Victor	8	1
Galva	8	1
Blue Mercer	8	1
Black Diamond	7	12
Early Lilac	7	12
Excelsior	7	12
Peachblow	7	12
Fluke	7	8
Great Western	7	7
Breesee's King of Earlies	7	6
Snap Dragon	7	6
Jackson White	7	5
" Red	7	4
Cow Horn	7	2
Nansemond	7	2
Week's Seedling	7	2
Early Minnesota	7	1
Irish Cups	7	--
German Russet	6	15
King of Potatoes	6	15
Whipple's Seedling	6	15
Early Velvet	6	15
Sutton's 100 Fold Fluke	6	13
Heason	6	12
State of Maine	6	11
Fancy Red	6	10
Saddling Rock	6	9
Philadelphia	6	9
Adirondac	6	9
Mercer	6	9
Ohio	6	9
Ohio Beauty	6	9
Early Russet	6	8
Early Henry	6	6
Vandevere	6	6
Early Cottage	6	6
Chili No. 2	6	5
Sandy Brown	6	5
Hollyhock	6	5
Dagger	6	5
Duke Cumberland	6	4
Early Don	6	3
Pigeon Eye	6	2
Noyes	6	2
Dwight	6	2
Compton's Surprise	6	1
Central City	6	1
Worcester Seedling	6	1
Early Golden	6	--
Early Handewarth	6	--
Mercer	6	--
Ohio Mercer	6	--
Early Indiana	5	15
Early Peach	5	14
Jones' Seedling	5	14
Pinkeye	5	13
Unknown	5	13
Late Rose	5	12
York Seedling	5	12
No Blow	5 lbs.	12 oz.
Cheeney	5	12
Whig	5	11
Flour Ball	5	11
Patterson's Albert	5	10
Forest Rose	5	9
Ohio Chenango	5	9
Lapstone Kidney	5	8
Strawberry Mercer	5	8
West Windsor	5	8
Titicaca	5	7
Multiply	5	7
Caster	5	7
Old Kidney	5	6
Breakfast	5	6
Davis Seedling	5	6
Early Stevens	5	6
Lincoln Red	5	6
Dyckman	5	5
Rough and Ready	5	5
Fancy	5	4
Ketchum's Seedling	5	4
Old Flesh-color	5	4
White Sprouts	5	4
Western Chief	5	3
Early Purple	5	2
Grey Russet	5	2
Jenny Lind	5	2
White Clinton	5	1
Scotch White	5	1
Guernsey	5	1
Mercer Seedling	5	--
Granite State	5	--
Concord	5	--
White Rock	5	--
Patterson's Regent	4	15
Early Scotch Cottage	4	15
Early Pearson	4	14
Worcester	4	14
Old Red	4	14
Quinby's Seedling	4	12
Prince of Wales	4	12
Blue Pinkeye	4	12
Black Chenango	4	10
Coffee Mine	4	9
Dr. Bretonnian	4	9
Early Mohawk	4	9
Ohio Russet	4	7
Ash-leaved Fluke	4	6
Calico	4	5
Carter's Early Foreign	4	5
Garnet Chili	4	4
Skerry Blue	4	3
Early Shaw	4	3
Brownell's Beauty	4	2
Alexander	4	1
Raspberry Leaved	4	1
Early Queen	4	1
Early Dexter	4	1
Unknown	4	--
Monitor	4	--
Early Kidney	3	15
Ash-leaved Kidney	3	13
Search Warrant	3	13

NAME.	YIELD.	NAME.	YIELD.
Snow Ball	3 lbs. 12 oz.	Spotted Shaw	2 lbs. 9 oz.
Red Kidney	3 12	Late Peach Blow	2 9
Purple Mercer	3 9	Coldbrook	2 7
White Chili	3 9	Black Kidney	2 7
Badger	3 8	True Monitor	2 6
Early Victor	3 8	Early Race Horse	2 5
Irish American	3 8	White Club	2 5
Missouri White	3 7	Early Sovereign	2 4
Acme	3 3	Ash Top Fluke	2 2
Delmahoy	3 3	Pink Eye	2 1
Early June	3 3	Pink Eye No. 2	2 ..
Patterson's Golden	3 3	Prince Albert	1 11
Royal Ash-leaved Kidney	3 3	Heins	1 9
Gardener	3 2	Tyrell No. 1	1 7
Yankee Flat	3 1	Merino	1 7
Andes	3 ..	Frankfort	1 7
Early Handel	3 ..	California	1 7
Irish Blue	3 ..	No. 2 Bush	1 6
Mona's Pride	3 ..	Milky White	1 5
Patterson's Seedling	3 ..	Cherry Blow	1 4
Moll Round	3 ..	Scotch Seebec	1 3
Rochester Seedling	2 15	Tayagua	1 1
White-eyed Peach Blow	2 14	Kidney	.. 14
Patterson's Blue	2 13	Late Pink Eye	.. 12
Scotch Blue	2 13	Farmer's Delight	.. 7
Mexican	2 13	Mountain June Pink Eye	.. 6
Amazon	2 12	Early Pink Eye	.. 6
Snow Flake 2d	2 12	Bradford's Red	.. 3½
Early White	2 12	Casco	.. ½
Bulkley's Seedling	2 12		

The experiment would be of very much more value, had we been able to increase the number of hills of each sort. We intend to repeat these trials on a larger scale next year. In looking over the comparative yield it must be remembered that the different sorts vary with the season, or the particular spot in which they happen to grow. Any careful observer knows that the same variety will often vary much in the same row. Again, it must not be forgotten that we cannot determine the merit of a potato by the scales or by the measure. Some of those yielding best are of very poor quality. Some will be good in one season and poor in another. Some will be good on one soil, or in one part of a country, and poor in another. Last year the Climax exceeded all the others in yield, but it was watery and unfit for human food.

To arrive at correct conclusions as to the relative merits of potatoes, is a complicated question, not so easily decided as, at first thought, might be supposed.

NEW VARIETIES.

Twenty new sorts of potatoes have this year been obtained from seed. Some of them were very large and promising for the first year. A large quantity of seeds from the balls of about 50 sorts has been saved for experimenting next year. Seeds of two species of wild gooseberries have been planted to get new varieties. In one case the berries came from a wild plant which had been thoroughly cultivated a year or two. Seeds from a plant in a vigorous unnatural condition, it seemed to me, might be more likely to produce plants which would be of new varieties. Seeds have also been sown of raspberries, of six sorts of currants, of grapes, of huckleberries, of wild or black haw, of strawberries, some of which were artificially crossed by fertilizing Wilson with pollen of the Michigan.

GRAPES.

The young vines bore a little this season. We have the following sorts on a terrace sloping to the south: Ives' Seedling, Rogers' 19, Hartford Prolific, Concord, Clinton, Rogers' 15, Rebecca, Rogers' 43, Taylor's Bullet, Cottage, Rogers' 3, Croton, Maxatawney, Rogers' 5, Martha, Goëthe, Creveling, Rogers' 4, Brant, Delaware, Eumelan, Norton's Virginia, Iona, Bradfield, Concord Seedling, Delaware Seedling, Cynthiana, Allen's, Diana, Lady, Adirondac, Canada, Black Hawk, Israella, Concord Chasselas, Concord Muscat. We have increased the amount of the terrace so as to have two hundred or more vines. We shall add twenty or more of the most promising new sorts next spring.

THE SWEET CHERRY trees are all dead but two.

PEACH TREES.

Two small peach trees were heavily pruned where they had grown in boxes, straw was put over each, and then a barrel set over that during winter. Four other young trees were covered in corn shocks, three others were tipped over and covered with sandy soil in which they grew. Those covered with the corn shocks and with barrels all died, one of those buried lived, and now has blossom buds on it. By mistake the trees were uncovered in April, a month too soon. I shall leave the dirt on in future till about the time to plant corn.

THE APPLE ORCHARD.

The experiments in culture have been continued as begun several years ago. The evidences look more and more strongly every year against the propriety of leaving trees, in our section, in grass. They have stood the severe winters no better; they have borne no better; the apples are smaller; the trees grow more slowly; a greater proportion of trees have died than of those cultivated each year. So marked have been the results, that we have plowed up about half that part of the orchard which was left in grass.

The most of the orchard has been plowed and cultivated till summer, then sowed to oats. We have been able this season, to complete tile draining the orchard. This is an improvement long needed. For want of it many trees have died, and many more are injured for life. In vacant places, were old stumps have been taken out, it has been very difficult to make trees grow. Large holes have been dug out in the fall previous to setting trees in spring. Unleached ashes, at the rate of 65 bushels per row, were placed evenly over the ground, on the tenth and eleventh rows from the east line, and on the third, and fourth, and fifth rows from the west side. In September, a heavy mulch of old hay and litter was put about eleven trees, the mulch extending half way to other trees. The trees mulched were on the east side, in the sixth row from the south line of the orchard.

A large load of well-rotted manure was placed evenly under each of three trees, half-way to other trees each way. The trees so manured were: A Northern Spy in 5th row from south and 11th row from the east; Baldwin, 7th row from the south and 10th tree from the west; Seek-no-Further, 11th tree from south and 2d from the west.

It is intended to keep up the mulching and manuring of these trees for a series of years in a uniform manner. The trees were lightly trimmed in the spring.

A few more apples were crossed while in flower, as years before. But few seeds were obtained. An effort was made to cross Siberian Crab apples with the

common apple. No fruit set. For want of any other place, the squashes, gourds, and pumpkins were planted in the orchard, scattered about remote from each other. The crop was poor.

The apple crop was almost a failure, as was generally the case in this part of the country.

The codling moths were few. They were caught by paper bands, as last year. But very few moths wintered about the orchards; indeed, we were not able to find any alive in the spring. They were all frozen to death,—something we never heard of before.

CLOSING REMARKS.

We have but a limited number of experiments to report. It is not for want of any to try or any desire to try them. The reasons are these: So much work in the class-room; all labor unskilled and frequently changing and uncertain; the constant care in person in looking after student labor in afternoons; the want of means to employ constant skilled help to direct students or to perform experiments. If the people want experiments of much extent, or cost, or value, they must say so, and see that means are provided. At present our force is not adequate to carry on well the ordinary routine of class-room, gardens, green-house, orchard, drives, and lawns.

I cannot close this report without returning thanks to the students who have worked in the Horticultural Department. Most of them have shown much zeal in their work; to Oscar Terrell, who has for two years so quietly and faithfully employed his time with the team in a great variety of places; to Mr. James Cassady, the gardener, who has been so watchful and skillful, day and night, summer and winter, in his charge of the green-house; and in an especial degree to my foreman, Mr. Charles W. Garfield, for his work at the State Fair, in charge of our collection, for his watchful care of work, and in teaching during my absence, and at all times and places, never forgetting the best interests of the students and all others.

Respectfully submitted.

W. J. BEAL,
Prof. Botany and Horticulture.

DEPARTMENT OF MATHEMATICS AND ENGINEERING.

MICHIGAN STATE AGRICULTURAL COLLEGE, *Dec. 1, 1875.*

To President Abbot:

I have the pleasure of submitting the following report of the Department of Mathematics and Civil Engineering:

CIVIL ENGINEERING.

Instruction was given in civil engineering to the Senior Class for a period of twelve weeks. Wood's revision of Mahan's Civil Engineering was used as a text book. The class passed over, under my direction, nearly the whole of the text

book, paying especial attention to those portions devoted to the properties of building materials, mortars, limes, and cements, strength of materials, processes of framing, principles of masonry, and the chapters on roads, canals, rivers. and bridges.

The course in the text book was supplemented by lectures on the strength of materials, principles of framing, strength of frame, strength of bridge, and the principles of road-making. The study of bridges was greatly advanced by numerous detailed drawings presented by the leading bridge companies of this country, enabling the students to observe how the theoretical principles are actually put into practice. The valuable collection of mechanical models was of material value, giving an opportunity to show (especially in the case of railroad cars, locomotives, and switches) a reduced form of the object under consideration.

Practical problems were given in framing and bridge designing, and the students were required to bring in original designs of the requisite strength to suit the conditions given.

ASTRONOMY.

Astronomy followed civil engineering, but the allotted time of thirty recitations was shortened to twenty-four, at the request of the class, who desired to pursue to a greater extent the study of practical agriculture. As the time was so limited, I deemed it advisable to pay attention only to the mathematical principles which underly the science.

Using White's Astronomy as a text book, we passed over thoroughly the chapters devoted to the general phenomena of the heavens, definitions of terms used in astronomy, astronomical instruments, refraction, parallax, methods of measuring, size, density, velocity of rotation, and centrifugal force of the earth, Foucault's pendulum experiment, methods of finding the latitude and longitude of a place, orbit of the earth, distance from the sun and how found, the constitution of the sun, sidereal and solar time, equation of time, the calendar, the moon and its phenomena, lunar and solar eclipses, and a general description of the planets.

I also afforded the class an opportunity, which most of them improved, of obtaining a considerable knowledge of descriptive astronomy. I met them usually three nights in a week on the roof of the boarding hall, and gave all of them an opportunity for observing the planets through the telescope now at the College, and pointed out to them the principal stars of the different constellations.

Instruction was given in Drawing to the Junior Class the first six weeks of the term. Warren's Projection Drawing was used as a text book. Especial attention was paid to principles of projection, to intersection and development of solids, and to shades and shadows. I required each student to draw at least two hours per day, he being under my supervision a portion of the time, and to finish ten plates, including a title page. The plates were of a uniform size, and were drawn on Whatman's paper with India ink, and were required to be above a certain standard, both as regards execution and accuracy, the object being to promote habits of neatness and exactness. I also gave one week's lectures on the principles of perspective drawing, but time did not permit the students to finish any plate in perspective when under my supervision.

SURVEYING AND LEVELING.

Surveying and Leveling were taught to the Sophomore Class at the beginning

of the second term. Davies' New Surveying was used as a text book, but being so poorly adapted to the wants of our course, most of the instruction was given by lectures. The course embraces theory, adjustment and use of instruments, rectangular surveying, as practiced in government surveys, areas of land, dividing land, finding section corners, retracing old lines, topographical surveying, railroad surveying, section and cross-section leveling, computation of earth-work, and setting slope stakes.

Particular stress was laid on the field work, no student being considered through the study who had not assisted in at least four compass surveys (in one of which he should run the compass) and run at least two lines of levels. I spent a portion of two Saturdays with the class, running a preliminary line of railroad between the College and Okemos village.

Each student was required to furnish himself with a few first-class drawing instruments, and to make two plates of actual surveys, with ornamented titles, the plates as large as a Whatman sheet of royal size would permit. In accordance with my suggestion, every three or four students united and purchased a Keuffle and Esser's book of specimen letters. The work of the class in surveying this year was, considering the limited amount of time at command, highly complimentary to the class. The whole class worked with so much enthusiasm and energy that I believe each and every one received sufficient instruction as to be capable of doing all ordinary surveying.

GENERAL OR ANALYTIC GEOMETRY AND CONIC SECTIONS.

The principles of Analytical Geometry and its application to straight lines, and the Conic Sections, were taught the Sophomore Class for a period of six weeks, to fill the time that usually has been devoted to Practical Agriculture. Instruction was given entirely by lectures. From the amount of benefit to be derived from this study, and from the fact that no great proficiency can be acquired in mechanics, astronomy or civil engineering without a thorough knowledge of analytic geometry, it is to be hoped that this study will take a permanent place in our course.

TRIGONOMETRY.

Trigonometry was taught to the Sophomore Class six weeks, using as a text book Robinson's Trigonometry. This year's work was unusually good, the class passing thoroughly over plane and spherical trigonometry.

GEOMETRY.

Geometry was taught eighteen weeks,—six weeks to the Sophomore Class and twelve weeks to the Freshman Class. The entire course in geometry is completed in twenty-four weeks, twelve of which are usually given in the Freshman year and twelve in the Sophomore year; but the present Sophomore Class had taken previous to this year eighteen weeks in geometry, so that there remained but six weeks for its completion.

The Sophomores commenced at Book VII. of Robinson's Geometry, and finished in the allotted time both plane and spherical geometry.

The Freshman Class used as a text book Olney's Geometry, and passed thoroughly over and were examined on the first 120 pages. On account of the large size of this class it was necessary to separate it into two sections. Each section, however, passed over the same space.

ALGEBRA.

From the fact that a great number of the students are acquainted with the elements of algebra when they enter, it was found necessary not only to divide the class, but it was thought best to provide different text books for the two sections. The time allowed for the completion of algebra is the same as geometry, viz.: twenty-four weeks. The advanced section, numbering 40 students, used as a text-book Olney's University Algebra, and passed over an extensive course, including differentiation and the higher theoretical algebra.

The other section, numbering 44 students, used as a text-book Olney's Complete School Algebra, and nearly completed the book, thereby acquiring a sufficent knowledge of the principles of algebra to creditably finish the remainder of the course.

RHETORICAL.

The Rhetorical exercises of the Freshman Class were not put into my hands until late in the first term, and it being necessary to be absent several times I could not meet the class regularly. For these reasons I deemed it best to make no report of the first term's work. The second term I met the class regularly on Thursday afternoon at 5. The exercises consisted of declamations and essays, or, when the student wished, I allowed orations to be substituted, crediting one oration equal to one essay and one declamation. On account of the size of the class each student was required to prepare one exercise only in four weeks, thus requiring during the term of each student two essays and two declamations. Generally speaking the exercises have been well prepared. The declamations have, without an exception, been well learned, and some of the orations have been really excellent.

OUTSIDE WORK.

During the greater portion of the year I have spent from three to five afternoons of each week in doing work not included in my regular College duties. The character of that work is shown by the following imperfect enumeration of the more important pieces of work.

In accordance with the desire of the State Board, I acted on the committee for rebuilding the Cedar river bridge, and prepared the design and working drawings from which the bridge was built. I have done a considerable amount of surveying of farm lines, boundaries of fields, and under-drains; in fact, I have done all that profitably can be done with our present instruments. For the purpose of registering the notes of surveys, and also for mapping, I obtained a book, and had copied therein all maps and notes of surveys that were in existence. I have also made two large maps of the farm and grounds, one of which is intended for class use, and is to be kept in the library; the other is intended to be sent to the Centennial Exhibition.

It is hardly necessary to remark that for want of a proper book heretofore, the records of several surveys heretofore made were lost, and it was necessary to make a resurvey of several old drains at a considerable expense to supply such omissions. A topographical survey of the farm and grounds is very much needed for educational purposes, but such a survey cannot be made with our present instruments, and it is to be hoped that facilities for performing this work will soon be furnished.

Very respectfully yours,

R. C. CARPENTER.

REPORT OF INSTRUCTION.

AGRICULTURAL COLLEGE,
Lansing, Michigan, Nov. 20, 1875.

To the President of the College:

I herewith present my report of instruction for the year 1875.

ANATOMY AND PHYSIOLOGY.

The course in these studies to the Juniors differed little from that of the previous year. The instruction was entirely by lectures, and the attention and progress left little to be desired. The time was felt to be too short by both myself and the class, as many important subjects had to be omitted.

ENTOMOLOGY.

Our time in this study was only half that given to the above, being but seven weeks. The results, considering the short time, were exceedingly gratifying. More attention was given to dissection under the microscope than ever before. Two or three students met me each day for this purpose, devoting an hour to the work. The results of these investigations were figured on the blackboard, and explained by the pupil making them to the class.

The work in the apiary was mostly performed by members of the class under my supervision. The experiments were performed largely by members of the class, and were watched with much interest.

ZOÖLOGY.

The course in this study was essentially the same as that of last year.

GEOLOGY.

This subject occupied the last five weeks of the year. Instead of lectures we made use of Dana's Revised Text Book of Geology. We went over it all except dynamical geology. The principles of dynamical geology, and the special geology of our State, were given in lectures in connection with historical geology. During the course we visited the outcrop at Grand Ledge.

The whole number of students in this course was twenty-four, three of whom were pursuing a special course.

MECHANICS.

During the second half year the entire Junior Class, together with one Senior and one special, recited to me in mechanics. We studied the mechanics of solids and liquids as given in Snell's Olmsted.

BOOK-KEEPING AND PHYSICAL GEOGRAPHY.

During the first half year I gave the Freshman Class instruction in the above mentioned studies. The first six weeks the class passed through Mayhew's Practical Book-Keeping. During the remainder of the year the class completed Guyot's Physical Geography, omitting those portions which receive attention

elsewhere in the course. This large class, numbering seventy members, were invariably attentive, and their progress left little to be desired.

RHETORICALS.

I had charge of the Sophomores during the entire year in rhetoricals. Each student was required to present an exercise every two weeks, which consisted of essays, alternating with declamations. The students were granted the privilege of presenting original declamations, which were made equivalent to two of the above. We thus had, especially during the last half year, a large number of orations.

The class were earnest, attentive, and for the most part made excellent progress.

PUBLIC LECTURES.

I have given during the year two public lectures at the College. Subjects: The Eye, and Sericulture.

OUTSIDE WORK.

During the year I have lectured once before the Ingham County Farmers' Club, twice before the Ingham County Teachers' Institute, and three times before the State Pomological Society. Among other executive work for the last mentioned society, I had charge of the fruit exhibition at the State Fair. I sent out over three hundred communications, urging people to exhibit, and supervised exclusively the arrangement in the halls. It gives me pleasure to state that this effort was not fruitless, as the magnitude and arrangement of the exhibition were universally praised. During my week's absence at the Fair my classes were continued through the kindness of Prof. Beal and Mr. Carpenter.

I was also absent for a week in August attending the meetings of the American Association for the Advancement of Science. I not only attended the general sessions, but also all those of the Entomological Section, including the field meetings. I cannot overrate the benefits of this experience, which will act as leaven in my instruction for all the future. Such opportunities are schools where the progress is so rapid and the instruction so varied, that I am sure they should never pass neglected. President Abbot and Mr. Carpenter kindly took charge of my classes during my absence.

Early in the summer my time was very much occupied in writing an article for the Report of the State Board of Agriculture on Injurious Insects, an elaborate article on Beneficial Insects for the Illustrated Annual of Rural Affairs, and in writing articles for the State press, many of which were in response to inquiries received from farmers and fruit growers. Such inquiries necessitated a large and laborious correspondence. Although this sometimes took from the energies which perhaps belonged to my classes, yet it is a demand which it is difficult to neglect; and the labor seems to be appreciated, and is, I trust, not wholly devoid of good.

RESEARCH.

I have during the year made investigations in several directions, which have served to make my instructions more complete.

THE CODLING MOTH.

1st. The larvæ seldom ever drop from the tree. This was determined by setting tubs partly filled with water under the apple trees. 2d. These larvæ do

not leave one fruit to complete their growth in an other apple. This was ascertained by putting affected apples in a box with sound ones, by examining affected apples and finding that the size of the opening and of the larvæ always corresponded, and by repeated examination of wind falls. 3d. A confirmation of the previously asserted truth that fully one-half of the larvæ never descend to the ground at all. 4th. It is exceptional for any larvæ to pupate after September 1st. 5th. The first brood of moths continue to come forth till about the 8th of July. 6th. Fine wire gauze placed in the windows of otherwise tight apple cellars will entrap very many moths that would otherwise escape and work mischief. 7th. Sweets will not attract the moths in the least. This last point I have tested fully. I have placed differently scented sweets all about the apple trees, and while I have caught hundreds of other moths I have never secured a single one of these.

ROBINS AND BLACK-BIRDS.

I have made a thorough and persistent examination of these birds, not only by closely observing them, but by repeated examination of the contents of their stomachs, and have arrived at the following facts: 1st. These birds are excessive insect eaters throughout the entire summer. 2d. It is very rare to find beneficial insects in their stomachs. 3d. A principal part of their food consists of cut-worms and the white grub. Hence, the advantage of fall plowing to destroy the cut-worms, and the exceeding ravages of the white grub in those sections where fruit is a specialty, and where the birds are destroyed to save the fruit.

APIARY.

I have also made several experiments with the bees, which will more properly appear in the report of the apiary.

A. J. COOK.

REPORT OF FARM DEPARTMENT.

To the President of the Agricultural College:

I herewith submit the following report:

The year has been a somewhat eventful one in this Department, as there have been several changes made. The resignation of Prof. Miles and the accepting of his position by myself on June 1 had some disadvantages, as the work for the year was already begun and well under way. The resignation of the old foreman, Mr. Hume, and the consequent appointment of a new foreman July 8, added to the disadvantages for the year. Early in the spring our bridge was taken away by ice, which necessitated for a long time a detour of from two and a half to three miles to reach the work, with the teams, on the back part of the farm.

A float bridge was constructed for the use of the students till a new bridge

could be built. Then new approaches had to be constructed and the old ones raised for use. The work now done is believed to be permanent.

The season has in many respects been a peculiar one; the spring was very late, and snow and ice came late, and retarded much of the work. At the close of the season copious showers of rain fell, and cool weather with early frost, injured somewhat the corn crop. The drouth in September injured the root crop, making them small, and not as large a crop as usual.

I take pleasure in calling attention to the account, as reported by the Secretary, of receipts and disbursements, viz.:

Total receipts, etc.	$5,489 16
" disbursements, including students' labor	4,807 33
Balance gain and increase of inventory	$681 83

There has been of student labor performed	$2,795 43
Less work for College	691 59
Student labor paid for on Farm Department	$2,103 84

The fields will be considered in their proper order, and first Field No. 1. This field was first in hay, and after mowing was pastured. The June grass had nearly driven out the tame grasses, and the result was not very satisfactory.

Plaster was sown on the field to the value of	$1 50
Hay produced at $8 per ton	64 37

Student labor	$3 39
Men and team labor	16 81
Total	$20 20

Field No. 2, adjoining the College grounds, was broken up but not sown or planted to a crop. The labor was as follows:

Student labor	$3 95
Men and team labor	66 90
Total	$70 85

Field No. 3 was planted to potatoes, 3 acres, and 20 acres to roots, Swedes turnips, and a small plat of two kinds of beets. 1st, The potatoes were of two standard varieties, viz., Peachblows and Early Rose, and a few hills each of Brownell's Beauty, Compton's Surprise, and Extra Early Vermont. They each did very well. A few rows were planted with bone super-phosphate in the hill, a few more with it sprinkled on. Some was also sprinkled on 6 rows of roots, but no perceptible difference could be seen this year, either in quantity or quality, that did not occur on other portions of the field. The Early Rose were planted May 15, and the Peachblows and others on the 20th. They were harrowed as they made their appearance, and then cultivated and hoed twice afterward.

The following is a summary of the potato crop:

Preparing ground and planting	$34 87
Seed	14 40
Manure	40 50
Cultivation	23 15
Harvesting	61 58
Paris green	3 75
Total cost	$178 25

The yield was 571 bushels of assorted and 93 of small potatoes; counting the latter at half-price, they cost 29 cents, nearly, for large, and 14½ cents per bushel for small ones. The root crop was sown after plowing and harrowing three times, then running a smoothing land-plane over the ground to level, picking the stones, etc. The roots were sown in drills 30 inches apart, and then thinned to 1 foot in the drills after coming up. They were cultivated three times, once in a row, and hoed twice,—once to thin them, and once to eradicate weeds. They made most of their growth after the heavy rains in the first week in October. The table shows the result:

Preparing ground, and sowing	$120 63
Picking stone	4 09
Seed	14 00
Cultivation	122 16
Harvesting	184 69
Manure	40 50
Total cost	$486 07

The yield was 9,160 bushels roots, 123 being beets. The tops were credited at $10, leaving $476 07 as cost of roots, or 5 1-5 cents, nearly, per bushel, or $24 30 per acre for cost of raising. The potatoes cost $59 42 per acre, with a less yield,—roots yielding 458 bushels per acre, and potatoes 221⅓ bushels.

The following is a summary of the field:

Student labor	$318 10
Men and team labor	233 07
Seed	28 40
Manure	81 00
Paris green	3 75
Total cost	$664 32

Cr. By 9,160 bushels roots and 664 bushels potatoes.

Field No. 4 was used to raise soiling corn partly, and partly for pasture. The cost of tillage was charged to stock at cost of production:

Student labor	$35 26
Men and team labor	27 80
Seed corn	2 00
Total	$65 06

It served to keep up the milch cows when the pastures were dry in September, and in October after frosts had come.

Field No. 5 was in wheat, at a cost of seeding of $109 72; harvesting and threshing, $75 48. Seeding to timothy and clover seed, $25, and labor, $1 47. making total of $26 47 for seeding. Other labor on the field was $34 39 for threshing out the remainder of oat crop of '74. Repairs of fences, $1 66.

The field was Cr. by 20 tons straw at $2 per ton	$40 00
401 bush. wheat at $1 20	481 20
Total	$521 20

Summary of labor on field:

Student labor	$45 73
Men and team labor	51 23
Total	$96 96

The field, being 17 acres, had 24 3-17 bushels per acre from machine. The straw was very rusty in some parts of the field, and the ice in winter killed at least one acre, on which there was no wheat. The wheat was sown with drill north and south, at the rate of 1½ bushels per acre, of the Deihl variety.

Field No. 6 was in pasture during the entire year. The labor was in relaying fence and fixing watering trough:

Student labor	$39 37
Men and team labor	19 50
Plaster	3 75
	$62 62

Field No. 7 was determined on as the next to clear, and the labor was mostly on wood. It was pastured with sheep and young cattle:

Student labor	$216 23
Men and team labor	91 55
Total labor	$307 78
Value of wood in field, as per inventory	522 58

Field No. 8 was in meadow:

Student labor	$120 23
Men and team labor	75 00
	$195 23
Cr. By 69 tons 1360 lbs hay, worth	$554 92

There was sown on the field plaster to the value of $2 81, and after second crop was mown, timothy seed, 6 quarts per acre: value, $14 83. It was then harrowed with iron-tooth harrows, to help the seed get covered, and is intended for meadow next year, the new timothy to take the place of clover killed out the preceding winter.

Field No. 9 had still some stumps, trees, and stones, and during the year has been cleared, so that there is no danger in running a reaper on any part of the field: cost, $73 34. This field was sown with oats in the spring, and followed with wheat, which crop is now on the ground. The account of oat crop is as follows:

Preparing for and sowing	$59 36
Seed	27 69
Harvesting	144 07
Cost of crop	$231 12
Cr.	
By 20 tons straw	$80 00
" 1,250 bushels (estimated)	151 12
Total	$231 12

This makes the oats cost now about 12 cents per bushel, and when the remainder of the crop is threshed, will only increase it to 13 cents. The field being 23 acres, the cost of tillage, harvesting, and threshing will be only about $10 60 per acre when all are threshed. The oats threshed show us that they were estimated fully too low. The west end of the field was sown with 590 lbs Excelsior, and the east with 1,625 lbs. of White Schoomen, and as far as observed the latter were the best yielders this year, both to the straw and per acre. Both varieties weigh 40 lbs per bushel of measure, of very fine quality. The crop would have been much larger were it not for a severe shower that lodged them badly in many portions of the field and necessitated their being mown by hand, thus costing much more for harvesting than if cut by reaper.

The wheat crop was sown Sept. 14 to 18 inclusive. The ground was plowed immediately after taking off the oats, and was finished Aug. 18. The ground was harrowed both ways and left till the oats should sprout. It was then cultivated with wheel cultivators each way, and then planed with a land planer, when it was in condition to sow. A severe shower at this juncture compelled me to cultivate the field once more, and harrow once, which was done before sowing. The field was sown to five kinds of wheat at the rate of 1½ bushels per acre, except the Asiatic wheat, which, on account of largeness of berry, did not sow over 1 bushel per acre. The wheat was sown in this order, commencing with the east end of the field, and drilled in north and south with a Beckwith roller drill: Wick's wheat, Asiatic wheat, Arnold's Gold Medal, Deihl, and Clawson, of the following quantities: 1st, 220 lbs; 2d, 45 lbs; 3d, 90 lbs; 4th, 1308 lbs; 5th, 273 lbs. The east part of the field was rolled, the west left unrolled. The east received 8 quarts timothy per acre, the west 6 quarts, which sprouted and grew well. The following is the summary:

Preparing ground and sowing	$118 06
Seed wheat	41 58
Cost of wheat	$159 64
Timothy seed	19 77
Sowing same	98
Cost of wheat and seeding	$180 39

This gives nearly $7 85 per acre for cost of sowing wheat and seeding to timothy.

The following is a summary of labor performed on the field for the year:

9

Student labor	$118 91
Men and team labor	276 90
	$395 81

Labor on oats	$203 43
" " wheat	118 06
" " seeding	98
" " per improvement	73 34
Total labor	$395 81

Field No. 10 was green sward and plowed for corn, commencing April 30. Commenced planting May 21, and finished May 22, except a small part of the field that required more labor to get ready. The back part of the field was very rough, and the "muck-bed," a portion of which was very bad, was not got into crop. About 20 acres were planted to White Dent variety. Commenced cultivating May 31, as soon as rows could be seen. The corn was planted in drills, four feet apart, and thinned when first hoed. The crop was cultivated three times, twice in each row, and hoed twice. The corn was cut and shocked on Sept. 13, 14, and 15, mostly. Twenty-seven hours' work finishing on the 16th, but even then the corn was not fully ripe, and the low ground in the west part of the field had been touched with frost. We just escaped the heavy frost that followed two or three days after. The following is a summary of the field account:

Student labor	$244 82
Men and team labor	266 21
Seed	3 38
Total	$514 41

Preparing ground and planting	$114 56
Cultivating	112 50
Harvesting	205 52
Labor on crop	$432 58
Seed	3 38
Cost of crop	$435 96
Per. improvement	78 45
Total	$514 41

The field is credited as follows:

40 tons stalks	$60 00
1220 corn (good) @ .244$\frac{1}{8}$	297 84
640 " (soft) @ .122 1-16	78 12
Total	$435 96

The harvesting includes husking and cribbing corn and stacking stalks near the barns, for winter use.

The cost per acre of this crop was $21 79, nearly.

Field No. 11 was in permanent pasture for the year, and had considerable clearing and stumping done. The field will be fenced from No. 13 next year, and is proposed to be put in corn, or at least a large part of it. The labor is this:

Students' labor	$62 04
Men and team labor	10 05
Total	$72 09

All permanent improvement.

Fields No. 12 and 14 combined and called 12, was also permanent pasture. It had some clearing of swamps and logging done. Also an old ditch was reopened, deepened, and widened. It was then extended into the large swamp in No. 12, making a ditch 174 rods long. In many places the labor of cleaning and enlarging the old ditch was more than to have dug a new one. The labor is as follows:

Labor on wood cut in 1874 to haul to boarding-hall	$153 29
Clearing, and repairing fence	82 04
Ditching	184 68
Total	$420 01
Student labor	$296 11
Men and team labor	123 90
Total	$420 01

This field, as well as No. 11, had grown up since chopping over, largely to thistles and mullens, that required mowing and burning, and that labor is charged as clearing. It is proposed to extend the large open ditch in No. 12 into and across No. 11 and 13 swamp, thus getting it dryer for future operations.

Of other labor of the department we have, 1st, the cattle barn, where we cut and prepare the feed for stock, and this year, after Sept. 30, did most of our grinding with a Challenge feed mill sent here for trial. The summary is:

Student labor	$81 29
Men and team labor	327 77
Total labor	$409 06
Produce consumed	1,675 28
Labor and produce	$2,084 34
Less manure	252 00
Cost for year	$1,832 34

Charged to stock.

The necessity for better power, either steam or something equivalent, is strongly felt, as, often, with the power we have, the work is slowly and inefficiently performed. With the increased acreage of productions soon to be grown

upon the farm, will come increase of stock to be kept, more cutting, threshing, and grinding, which should all be done at home and by our own labor, and will demand more and steadier power than a two-horse tread-power.

The horse-barn has been kept this year at an expense, as follows:

Student labor	$23 11
Men and team labor	32 70
Total	$55 81
Hay and grain	393 02
Total	$448 83

The student labor is mostly in cutting hay by hand; the men and team labor in going to mill, time consumed in getting team shod, etc.

The sheep-barn expense is as follows:

Student labor	$17 11
Men and team labor	19 65
Total labor	$36 76
Hay and grain	347 51
	$384 27

The granary had some labor performed, as cleaning wheat for market and seed, and shoveling over grain till thoroughly seasoned:

Student labor	$10 37
Men	15
	$10 52

The east granary should be thoroughly overhauled and made vermin-proof during the coming year. The west one is now so.

The piggery had some labor on yards to keep them in order. The labor of care of pigs was charged to stock.

Student labor	$2 07
Men and team labor	2 10
Total	$4 17

Fifty Essex pigs of nearly the same size and age, have been purchased for feeding experiment the next year.

The office expenses were as follows:

Student labor	$0 83
Men and team labor	1 20
Total labor	$2 03
Coal used	29 98
Stationery, blank books, stamps, etc.	15 85
Total	$47 86

The farm department general account is as follows:

Student labor	$66 85
Men and team labor	97 42
Total labor	$164 27
Oil	3 60
Total	$167 87

Summary—

Construction of float and bridge	$39 03
Painting with crude oil	6 04
Making bridge approaches	66 60
Miscellaneous	56 20
Total	$167 87

The miscellaneous includes team work for department, in going for various things connected with it, as getting bills in each month, looking up seed potatoes, after debts, etc., etc.

The stock account Dr. and Cr. is given in the receipts and expenditures. The summary of labor is as follows:

Student labor	$317 24
Men and team labor	684 69
Total labor	$1,001 93

The milk not needed at the hall and other places was made into butter at a cost of $3 78 to Dec. 1, and the butter sold and credit given stock. There is a slight decrease of inventory from the preceding year, owing to the large sale of stock to the Nebraska Agricultural College, besides the ordinary yearly sales.

The work in the shop was not very large for this year, as there was very little building and repairing done. The following is the summary:

Student labor	$80 44
Men and team labor	5 25
Total	$85 69
Repairs	$28 81
Care of tools	56 88
Total	$85 69

The student labor in the shop has been very satisfactory, although more costly than regular mechanic labor. It is in the main instructive in its nature.

The Board having ordered the department to exhibit at the State Fair, 20 head of cattle were taken care of for ten days previous in stables, to accustom them to the change of feed, and then taken to the fair with 10 sheep. The labor was as follows:

Student labor	$33 56
Men and team labor	30 90
Total	$64 56

This is charged to the College account, as it was not within our department.

During the summer a large compost heap was constructed of alternate layers of swamp muck and barn-yard manure, in the proportion of about three parts of muck to one of manure. The heap contains 1,500 cubic yards, and the account is as follows:

Student labor	$105 71
Men and team labor	65 93
Manure	187 50
Cost	$359 14

Or about 24 cents per cubic yard for the compost. This will cost about 55 cents per cubic yard delivered on our back fields, such as Nos. 8, 9, and 10, and from 35 to 45 on the fields nearer the barns.

The remainder of the labor was done for the college, and is divided as follows:

Special duty	$19 22
Mapping farm and grounds	23 24
Plotting drains	19 44
Building account	94 07
Grading and breaking around new houses	210 91
Orchard drains	281 71
Repairing fences	15 02
Labor on lawns	74 49
Teaming for College	32 73
Straw for covering cistern and banking	2 50
Total	$773 33
Cr. By hay from lawn	81 74
Tlota	$691 59

For which the department has credit. The special duty was showing visitors about our buildings, green-house, and grounds, and frequently so many were here at one time that more than one was required for this duty. The drain records were heretofore on detached records, but a book has been procured into which all drain notes are copied, and descriptions of the land of College Farm proper. On the pages opposite the notes a neat plat is made of the drain or parcel of land described, with the accompanying scale. This work, as well as that of making two maps of the farm (one for the Library and one to be sent to the Centennial), has been in charge of Mr. R. C. Carpenter, instructor in mathematics and civil engineering. The grade at the new houses was begun rather late in the season, and pushed as fast as the means at our command would allow. The grading was nearly completed and the adjacent land broken up for frost action and spring work, and is then to be seeded down, it is hoped, much smoother than before.

The labor on lawns and drives in Farm Department was more than paid for by hay received from that part mown, leaving a profit of $7 25.

In the general work of the department there have been some changes. Two carts and harnesses were purchased, which facilitated very much the moving of muck and earth for short distances. The first half of the year the wages were at the old rates; the last half the regular labor was paid for at a maximum of 10 cents per hour, and 12½ cents for extra. The increased interest of the students was at once apparent, and, in my judgment, the work was increased

nearly one-half in my department. I would, however, recommend that 10 cents per hour be paid for maximum of regular and extra labor for the coming year.

The manure has been charged to the fields at 50 cents per load, and in making compost one cubic yard has been called a load, and charged accordingly. The plaster bought cost $7 50 per ton, and was sown at the rate of about 40 lbs per acre. The plan of crops for the coming year is:

No. 1. Soiling crops.
No. 2. Oats, or Corn, or both.
No. 3. Oats, followed by Wheat.
No. 4. Soiling Corn, Rye, and Pasture.
No. 5. Meadow.
No. 6. Corn.
No. 7. Wooded Pasture.
No. 8. Meadow.
No. 9. Wheat (to be harvested in 1876).
No. 10. Roots and Potatoes.
No. 11. Corn.
No. 12. Pasture (includes 14).
No. 13. Pasture.

The department is in good working order at the close of this year, and starts out with a good prestige for the next.

All of which is respectfully submitted,

A. B. GULLEY,
Prof. Agriculture.

SALARIES OF FACULTY AND OTHER OFFICERS OF THE COLLEGE.

Theophilus C. Abbot, LL. D., President, Professor of Mental Philosophy and Logic, $3,000.

Robert C. Kedzie, A. M., M. D., Professor of Chemistry and Curator of the Laboratory, $2,000.

George T. Fairchild, A. M., Professor of English Literature and Librarian, $2,000.

Albert J. Cook, M. S., Professor of Zoölogy and Entomology, and Curator of the General Museum, $2,000.

William J. Beal, A. M., B. S., Professor of Botany and Horticulture, and Curator of the Botanical Museum, $2,000.

Robert G. Baird, Secretary, $1,250.

Alfred B. Gulley, Professor of Practical Agriculture, $2,000.

Robert F. Kedzie, M. S., Assistant in Chemistry, $600.

Rolla C. Carpenter, B. S., C. E., Instructor in Mathematics and Civil Engineering, $1,000.

Charles W. Garfield, M. S., Foreman of the Gardens, $600.

Charles L. Ingersoll, B. S., Foreman of the Farm, $600.

George W. White, Assistant Foreman of the Farm, $500.

James Cassidy, Gardener, $600.

James M. Short, Steward, $700.

FARMERS' INSTITUTES.

In the preparation of this report of the Institutes I have endeavored to carry out as fully as possible the general plan presented in the following resolution adopted by the Faculty:

"*Resolved*, That the printed report of the Farmers' Institutes for 1876 shall contain the following, and in the following order:

"1st. A general history of the enterprise, up to the meeting of the Institutes, including the action of the Faculty and of the Board of Agriculture, and the names of all the places that applied for an Institute.

"2d. A history of each Institute, including the order of exercises, the address of welcome, the papers of the members of the Faculty that were read but once, the papers other than by members of the Faculty, and the discussions on the same, motions and resolutions at the close of the meeting.

"3d. The papers by members of the Faculty that were read at more than one Institute. Following each paper shall be given the discussions on that paper, in the chronological order of the Institutes, as far as possible."

Personally, I feel under great obligations to Mr. J. W. King of the Lansing Republican, for the valuable assistance rendered while this report has been passing through the press. For his excellent report of the discussions of the Institutes which he attended, he has the sincere thanks of every member of the Faculty.

R. G. BAIRD,
Secretary.

GENERAL HISTORY, INCLUDING THE ACTION OF THE COLLEGE FACULTY AND THE STATE BOARD OF AGRICULTURE RELATING TO THE INSTITUTES.

A new and important feature of the work of the Agricultural College during the year 1875 has been the inauguration and carrying forward of a scheme for the holding of Farmers' Institutes in different portions of the State. As the farming community has taken a very lively interest in those Institutes, and many inquiries are being made regarding them, we propose here to state the objects which the State Board of Agriculture and the Faculty of the College had mainly in view in inaugurating those meetings, and also the manner in which those held during the month of January, 1876, were conducted. In order that the benefits of those Institutes may not be confined to the localities where they were held, but extended to agriculturists generally, there is given in this

report the lectures, essays, and addresses delivered at the Institutes, and also the discussions by which a portion of the time was most agreeably and profitably occupied.

The expediency of holding Farmers' Institutes in different portions of the State had frequently been a subject of discussion by the members of the College Faculty. At a meeting of that body, held May 7th, 1875, the following resolutions were presented by Prof. R. C. Kedzie, and unanimously adopted:

"*Resolved*, That a committee of three be appointed by the President to draw up a scheme for a series of Farmers' Institutes to be held in different parts of the State during the next winter; including in the exercises of such Institutes lectures and essays by members of the Faculty; that the several members of the State Board of Agriculture and leading farmers residing in the vicinity of the place of holding such Institutes, be respectfully and earnestly requested to participate in the exercises by lectures, essays, and discussions."

"*Resolved*, That said committee be instructed to confer with the State Board of Agriculture, at its next meeting, to make all necessary arrangements for inaugurating and carrying out such series of Farmers' Institutes."

President Abbot appointed as such committee, Professors R. C. Kedzie, W. J. Beal, and Mr. R. C. Carpenter.

At the next meeting of the State Board of Agriculture, which was held commencing June 1st, the above committee presented the following memorial:

To the Hon. Board of Agriculture:

At a meeting of the Faculty of this College, held May 5th, it was unanimously resolved that a committee be appointed by the President to draw up a scheme for a series of Farmers' Institutes to be held under the supervision and direction of the State Board of Agriculture, in different parts of the State during the coming winter; that the exercises of such Institutes shall consist of lectures, essays, and discussions of previously selected topics; that the several members of the Board, and leading farmers residing in the vicinity, be invited to take part in all such meetings, and the members of the Faculty will take such part as the Board may think best.

It was also resolved that the committee confer with the Board at its next meeting, and arrange for such a series of Institutes.

In accordance with these resolutions, the undersigned were appointed a committee to place the matter before the Board of Agriculture, and to ask you to inaugurate and carry forward such a series of Farmers' Institutes during the coming winter.

Whatever may be the cause, we think the *fact* is sufficiently evident that there is a want of sympathy between the farmers and the Agricultural College. By reason of this want of sympathy the farmers are deprived of much of the good which they may secure from the Agricultural College, and which they have a right to demand; and the College is crippled in its work for the same reason. We believe that this want of sympathy and lack of interest are because the farmers, as a class, know but little of the real working of the College, and that if the Board and Faculty could be brought into more intimate association with farmers in all parts of the State, these evils might be removed. If the College is not doing such work as ought to command the confidence of intelligent farmers in all parts of our State, then our system should be altered so as to meet the just demands of the farmers; if we are doing such work, we may still fail of our duty if we fail to make this fact known. There is something wrong when the College, after 16 years of continuous work, is still denounced and decried in some of the most flourishing agricultural sections of our State.

We therefore ask the Board of Agriculture, who are the agents of the people to manage and control the College for the good of the whole State, to arrange for holding six Farmers' Institutes during the month of January, 1876. These meetings should be understood to be the first of a series of meetings which will be held winter after winter, if the interest of the agricultural public shall warrant. These first meetings should be held in the older-settled portions of the State. We would suggest that one be held in each of the following counties: Macomb, Lenawee, Branch, St. Joseph, Cass, Van Buren.

We ask the Board of Agriculture to take upon themselves the responsibility of the whole thing; to invite speakers, essayists, and persons to lead off in discussion on topics selected and announced in advance; to preside at such meetings or to select presiding officers, and to make all arrangements necessary to make these Institutes a

success. We would also respectfully suggest that each Institute begin with an evening meeting, with an address and topic for discussion, and that the next day be entirely given up to the work of the Institute, to close with a meeting on the evening of the second day. Two such Institutes could be held in each week, and the whole concluded in three weeks, beginning with January 10.

The members of the Faculty will take such part in the meetings as the Board may deem advisable, but we would suggest that not more than two members of the Faculty take part in any one meeting. One essential element of success will be to secure the active coöperation, by addresses, essays, and discussions, of leading farmers in the region in which the Institute is held. The Institutes will be feeble in interest and impotent for good without such active assistance of representative farmers.

The length of time assigned for an Institute may seem short, but brief, spicy, and wide-awake meetings will more naturally be secured, and if the time is too short as shown by experience, it may be extended hereafter. Better too short than too long.

We also suggest that a competent reporter be employed to prepare an extended report of these meetings for insertion in the Annual Report.

Invitations for such meetings should be secured through Farmers' Clubs, Granges, etc. If these Institutes are held because *the people ask for them*, the influence will be much better.

The local expense of such Institutes should be borne by the people of the vicinity: *e. g.*, for hall, fire, lights, etc.

Such is a brief outline of the subject. There may be many crude and impracticable ideas embraced in our scheme, but we want the College and the farmers to come nearer to each other, to be a mutual benefit to each other, and to see the College take such a position in agriculture and associated arts that it shall be the pride and boast of the farmers of every section of our State.

We very well know that in requesting the Board to inaugurate such a series of meetings, and to take the control and guidance of the same, we are asking you to assume an onerous responsibility. But the State authorities in placing you as the responsible head of the Agricultural College, have thereby placed you as the leaders of the agricultural educational interests of the State. By your position you must take the lead in all efforts which aim to develop an intelligent interest in whatever shall benefit this overshadowing industry. Compared with our agriculture, all other productive industries in our State must speedily take a secondary position. Our lumbering will soon cease, for the axe and the saw will soon have done their work. Mining itself must take a subordinate position in our State, but our agriculture will go on increasing in extent, variety, and absolute value to the end of time.

The farmers of our State have, therefore, a right to demand for themselves and for their calling all that is most helpful and stimulating, to aid this great industry; and the Agricultural College, and all connected with it, will fail of their duty if they are not foremost in every movement which shall tend to the improvement of agriculture.

Agricultural College, June 1st, 1875.

Respectfully submitted.

R. C. KEDZIE,
W. J. BEAL,
R. C. CARPENTER,
Committee.

The Board appointed a committee, consisting of Hon. J. Webster Childs, Hon. A. S. Dyckman, and Hon. Milton J. Gard, to make all necessary arrangements for the successful carrying out of the suggestions contained in the report read by Prof. Kedzie.

At the next meeting of the State Board, which was held commencing August 24th, a petition was presented from the members of the Armada (Macomb Co.) Agricultural Society, and one from the Rochester (Oakland Co.) Grange, requesting the holding of an Institute at each of these places. These requests were granted, and a resolution was passed inviting the College Faculty to furnish a list of the subjects on which they would speak at the various Institutes to be held during the winter, and requested Prof. Kedzie to write an article setting forth a general plan for the Institutes, and the objects sought to be secured by them, and to have the article published in several of the leading papers of the State.

The following article was published in the Lansing Republican Sept. 21, 1875, and in other papers about the same time:

FARMERS' INSTITUTES FOR 1876.

At a meeting of the State Board of Agriculture held last June, the Board determined to hold a series of Farmers' Institutes during the month of January, 1876. They resolved to hold six Institutes. These Institutes are the first of a series to be held winter after winter if the interest of the agricultural public shall warrant. It is the desire of the Board to hold these Institutes in different parts of the State, to subserve the best interests of those engaged in agriculture and kindred pursuits.

LENGTH OF THE MEETING.

It is the design that the Institute shall not be long, or wear out the patience and endurance of the community. Short, spicy, wide-awake meetings are what is desired. The Institute will open with an evening meeting, and the whole of the next day and evening will be devoted to the work. It will thus embrace two evenings and one day. If it is found that the time is too short, a change may be made hereafter; but it is not designed to make it a protracted meeting in any sense.

WHEN TO BE HELD.

The Institutes will begin after the fall and early winter work is out of the way, and the season of the holidays fully past. They will begin with the week commencing January 10, and two Institutes will be held each week till all are closed.

WHERE THEY WILL BE HELD.

This is for the farmers to settle for themselves. Application has been made for one Institute by the Armada Farmers' Club, and another by the Detroit and Bay City District Council of Patrons of Husbandry. These invitations have been accepted, and the first Institute will be held at Armada and the second at Rochester. Four more Institutes are yet to be located. These will be located by the committee of the Board having this matter in charge, on application by Agricultural Societies, Farmers' Clubs, Granges, and other organizations designed to advance the cause of agriculture. Early application should be made to secure an Institute.

TO WHOM TO APPLY.

The committee having in charge these Institutes consists of the following members of the Board: Hon. J. Webster Childs of Ypsilanti, Chairman; Hon. A. S. Dyckman of South Haven; and Hon. Milton J. Gard of Cassopolis. Application may be made to any member of the committee. The details of each Institute will be arranged by some member of the committee. A local committee should be appointed at each place where an Institute is to be held, to assist the committee of the Board in perfecting the details of the meeting.

EXPENSES.

The community where the Institute is held will be expected to furnish the hall, and provide for warming and lighting the same. All other expenses will be borne by the Board of Agriculture.

WHO WILL TAKE PART IN THE MEETINGS.

It is expected and earnestly desired that leading farmers in the vicinity of the Institute will give lectures, read essays, and take part in the discussions. It is expected that the discussions will be of especial interest, in which farmers will give their views and relate their experience upon the topics proposed for discussion. As the topics for discussion will be selected by the local committee where the Institute is held, the public will thereby be assured that such topics for discussion will be presented as will be of especial interest to that community. The members of the Board will also take part in the proceedings, and the members of the College Faculty will take part if so desired.

WHO ARE INVITED.

Every one who tills the soil or is interested in agriculture. Farmers and their wives and families are especially invited; also all who honor or would benefit the noblest of all industries.

ORDER OF BUSINESS.

The order of business will be determined by each Institute for itself. The following programme is suggested if no better one is found: The Institute to begin with an evening meeting, with a lecture upon some previously announced subject, to be followed by a discussion on the subject of the lecture, or on some previously selected topic. The morning and afternoon will be given up to essays, lectures, and discussions on selected subjects, giving especial prominence to the relation of experience of farmers upon the subject under discussion. The Institute to close with an evening meeting with an essay or lecture, and discussion. The meeting will be so short that every farmer and his wife can afford to attend the whole meeting.

OBJECTS.

1. It is not the design to secure mere rhetorical efforts, but to meet and talk over, in a common-sense way, matters of vital interest to the farmer.

2. One object to be secured is to bring the farmers, the Board, and the Faculty of the Agricultural College in closer relations to each other, in hope of mutual benefit, that the teacher may have the benefit of the broad and extensive experience of the farmer, and that the farmer may perhaps derive hints from the teacher, to be put in practice on the farm.

3. One very important object to be secured is to gather up and preserve in permanent form the results of agricultural experience and the views of leading farmers in different parts of the State. For this purpose a short-hand reporter will attend the Institute to make a complete report of all addresses, essays, and discussions, to be printed in the annual report of the State Board of Agriculture.

4. Finally, to give a broader scope to the instruction at the Agricultural College, and to make it more fully than ever before the exponent of the most progressive and advanced agriculture of our State.

Farmers of Michigan! Will you "meet the Board half-way," in this effort for mutual benefit?

R. C. KEDZIE.

Agricultural College, Sept. 13, 1875.

Both the State Board of Agriculture and the College Faculty were generally of the opinion that they should not make arrangements for more than six Institutes during the winter, and when, at the November meeting of the State Board, it was found that Hon. J. Webster Childs, Chairman of the Committee on Farmers' Institutes, had received between thirty and forty applications for Institutes to be held at as many different places, it was likely to be a difficult matter to decide where they should be held. It was, however, agreed that the least objectionable way to settle the matter would be according to priority of application, holding the Institutes at the places where they had first applied for them, having in view a proper geographical distribution in the State, giving two Institutes to the eastern, two to the western, and two to the southern part of the State, provided that two could be held nearly on the same line of travel, thereby lessening the amount of traveling expenses. In accordance with this plan, Hon. J. Webster Childs, Chairman of Committee, reported the following arrangement for holding the Institutes, which was unanimously adopted:

At Armada, Macomb county, Jan. 11 and 12, to be attended by the following members of the college faculty: Pres. T. C. Abbot, Profs. W. J. Beal and A. B. Gulley, and Mr. C. L. Ingersoll, foreman of the farm.

At Rochester, Oakland county, January 13 and 14, attended by the same representatives of the college as that at Armada.

At Allegan, Jan. 11 and 12, attended by Profs. Geo. T. Fairchild, R. C. Kedzie, A. J. Cook, and Mr. R. C. Carpenter.

At Decatur, Van Buren county, Jan. 13 and 14, attended by the same representatives of the college as are assigned to Allegan.

At Adrian (time not fixed), attended by Profs. Geo. T. Fairchild, R. C. Kedzie, A. J. Cook, and Mr. Garfield.

At Coldwater (time not fixed), attended by Pres. T. C. Abbot, Profs. W. J. Beal, A. B. Gulley, and the Secretary, R. G. Baird.

The time of the two last named Institutes was left indefinite, that they might be so arranged as not to interfere with the annual meeting of the State Agricultural Society. It was soon after arranged to hold the institute at Adrian on the 18th and 19th, and that at Coldwater on the 20th and 21st of January.

Immediately after the meeting of the Board the above arrangement was published in the Detroit daily papers and in the Lansing Republican, accompanied with the following statement:

The representatives of the State Agricultural College attending these Institutes will be prepared to lecture on any of the following subjects, and will select from these topics as far as possible to suit the wishes of parties in the localities where the Institutes are to be held:

Pres. T. C. Abbot: 1, "Industrial Education;" 2, "The Agricultural College."

Prof. A. J. Cook: 1, "The Apiary,—its pleasures, profits, and management,—should it supplement the labors of the farm?" 2, "The three worst insects of the farm,—how can we conquer them?" 3, "Fruit or insects, which?"

Prof. W. J. Beal: 1, "Grasses and Forage Plants;" 2, "The Farmer's Garden;" 3, "Landscape Gardening for the Farmer."

Prof. A. B. Gulley: "Improved Husbandry."

Prof. R. C. Kedzie: 1. "Plaster;" 2, "Muck;" 3, "Poisons in Agriculture;" 4, "A talk on lightning-rods."

Prof. Geo. T. Fairchild: 1, "Division of Labor on the Farm;" 2, "Education,—who needs it and who can afford it."

Secretary R. G. Baird: "The Prospective Benefits of the Centennial Exhibition."

Mr. C. L. Ingersoll: 1, "Farm Drainage;" 2 "What stock shall we keep?"

Mr. C. W. Garfield: 1, "Beautifying our Homes;" 2, "The Farmer as a Student."

The appointments made by the State Board with regard to professors and other representatives of the college to attend the several institutes was carried out except in the following instances: Professors W. J. Beal and A. B. Gulley were unable, on account of sickness, to fulfill any appointments made for them, and Mr. C. W. Garfield did not attend the institute at Adrian, having been summoned three days before to Grand Rapids, to the death-bed of his father, Hon. S. M. Garfield.

The Secretary, R. G. Baird, and Mr. C. W. Garfield attended the institutes held at Armada and Rochester, in place of Professors W. J. Beal and A. B. Gulley. In addition to the appointments made for them, President Abbot attended the institute at Adrian, Prof. Kedzie the one at Coldwater, and Mr. Ingersoll both at Adrian and Coldwater.

PLACES THAT APPLIED FOR AN INSTITUTE.

The following is only a partial list, but is as nearly complete as can be furnished from present data:

Hillsdale—F. M. Halloway, Sec.
Plymouth—H. O. Hanford, Canton.
Allegan—E. C. Reid.
Ypsilanti—
Coldwater—C. G. Luce, Gilead.
Lansing—R. E. Trowbridge.
Howell—E. I. Merithon, Howell.
Lambertville—J. J. Sumner.
St. Johns—R. W. Maxam, H. Hammond, Richard Moore.
Mason—A. M. Chapin, Eden.
Charlotte—O. E. Chappell.
Albion—A. M. Fitch.
Portland—N. B. Rice.
Chelsea—Geo. H. Mitchell.
Greenville—L. C. Lincoln.
Decatur—Volinia Club and Grange.

Adrian—A. H. Briggs.
Armada—Chas. Andrews, etc.
Cassopolis—C. C. Allison.
Rochester—C. K. Carpenter.
Constantine—Grange—Jas. Richards, Levi T. Hull.
Hudson—C. A. Jewell.

RECORD OF EACH INSTITUTE.

ALLEGAN.

The Institute at Allegan was held, commencing on Tuesday evening, January 11th. It was attended throughout by a large and deeply interested audience, and the programme previously arranged was most successfully carried out.

The meeting was called to order, and in the absence of Gen. B. D. Pritchard, President of the County Agricultural Society, Hon. Thomas Shepherd was chosen chairman for the evening.

Rev. J. Sailor of Allegan delivered a short opening address, in which he spoke of the nobleness and utility of agricultural pursuits, and the advantages to be derived by farmers from education. In closing, he welcomed the gentlemen from the State Agricultural College who had come to aid in the exercises of the Institute. We regret that before putting this report into the hands of the printer we have not been put in possession of a copy of this address, that we might have reported it in full.

Prof. Geo. T. Fairchild, on being introduced to the audience, delivered his lecture entitled "Education: Who need it and who can afford it." This address, with others, is given in full, following the reports of the Institutes.

Next on the programme was an essay by Mr. Clubb. That gentleman being absent, the essay, by vote, was read by E. C. Reid of Allegan.

FRUIT-GROWING IN MICHIGAN.

Delivered January 11th, 1876, before the Agricultural Institute held under Direction of the State Board of Agriculture at Allegan, Michigan, by Henry S. Clubb.

Fruit-growing in Michigan is a subject richly deserving the attention of Michigan farmers, and especially of those whose farms are located in those counties bordering the great lakes, of which Allegan is one of the most fortunate, in soil and situation.

The subject is most naturally divided into three principal branches, which, like the limbs of a fruitful tree, again divide into numerous lesser limbs:

First—Its History.

Second—Its Present Status.

Third—Its Prospects.

I. ITS HISTORY.

Fruit-growing commenced in the territory now known as the State of Michigan at a very early period. Long before any effort was made by man, the Creator caused fruits of various kinds to spring up from the soil in great profusion.

The precise period when this wonderfully productive and extensive fruit garden was first planted, human history fails to record, and Indian tradition gives us no clue to the mystery. Soon after the subsidence of the waters which at one time covered this territory, the spontaneous fruits of the earth probably made their appearance, and a brief consideration of what are called the "wild fruits of Michigan" will be in order here.

The Wild Fruits of Michigan.

The principal wild fruits of our favored State are as follows:

Apples—Crab-apples, Thorn-apples.

Berries—Cranberries, Billberries, Blackberries, Blueberries, Dewberries, Gooseberries, Mulberries, Raspberries, Strawberries, Thimbleberries, Wintergreen berries, Whortle or Huckle berries.

Cherries—Black Cherries, Choke Cherries, Red Cherries, Yellow and Blue Ground Cherries.

Currants.

Grapes.

Mandrakes.

Nuts—Beechnuts, Butternuts, Chestnuts, Hazelnuts, Hickorynuts, Walnuts.

Paw-paws.

Plums.

Knowing that this list is incomplete, I shall esteem it a favor for any one to furnish the names of other wild fruits of consequence which I may have omitted, so that should this paper be printed in permanent form, the list may be rendered as complete as possible. But the list as here presented shows that there are many valuable fruits indigenous to Michigan, and the fact that the best of these are produced in great abundance, and command a high price when gathered and placed in market, shows that Michigan is and long has been a fruit-producing State, and would, without the aid of horticultural skill, naturally occupy that position and acquire that character among the sister States.

It is true, with the choice productions of orchard and garden before our eyes, we are apt to think lightly of these natural emanations of forest and swamp, but so abundant are the wild fruits of Michigan, and so fine in quality are most of them, that it can hardly be said that persons residing in the vicinity of many of our fruitful forests and marshes, avail themselves of their natural advantages if they do not participate in the harvest so bountifully provided without human labor, and "without money and without price."

These wild fruits do not figure in our census returns. In fact, until 1874 the State never collected the statistics of fruit at all, and it is only now that the fruit-growing interest has risen to the dignity of millions of dollars in its annual returns, that statistics in regard to it have been collected by State authority. It may reasonably be assumed that the systematic harvesting and marketing of the wild fruits that now grow and annually decay, would, after paying all expenses, more than pay the expenses of our State government, including the support of our benevolent institutions and even the construction of our State Capitol.

The Cranberry.—The Cranberry crop produced in the marshes of Michigan alone is immense, and the efforts to collect it and ship it, although seldom realizing less than $10 a barrel, are only partial and local, seldom reaching the main crop.

Whortleberry and Raspberry.—Next to this in importance is the Whortleberry in the Lower Peninsula, and the Raspberry in the Upper. In June the

marshes of Michigan, some of which are in Allegan and Ottawa counties, are white with the beautiful, wax-like blossoms of the Whortle, or Huckle berry, as it is most commonly called. Both of these fruits are highly esteemed, and command a price equal to that of our most popular garden or orchard fruits. And yet thousands of acres annually offer their load of wealth in Michigan, and the people are too busy, complaining of hard times, to stretch forth their hands to gather and market these valuable and extensive crops. The raspberry, which grows wild all over the State, so far as explored, is particularly productive in the northwest. The Upper Peninsula, usually regarded as too cold for fruit growing, is in fact a vast raspberry garden, and the crop is of immense value to the miners and others who would otherwise depend on imported fruits. The raspberry produced there so abundantly differs little, if any, from the Philadelphia raspberry of our catalogues, and appears to be about as productive and large when favorably located. The deep snow which usually covers the raspberry cane in the Upper Peninsula, secures it from destruction during the severest cold, and the remarkable health of the people of this region may, in a great measure, be attributed to the abundance of this wholesome fruit.

The Blackberry.—I think I am doing no injustice to the Blackberry in placing it next to the raspberry as a natural production of Michigan. It is already largely marketed in the Lower Peninsula, and will always command a good price, as it contains medicinal as well as dietetic properties which render it invaluable. Its importance is increased from the fact that it springs up all over that extensive region of country where lumbermen have taken away the pine, and where the agriculturist has not yet taken possession. It seems to be impossible, with the utmost ingenuity and persistency, for man to make an unproductive wilderness of Michigan; for no sooner has the pine been stripped from our forest, and the fires which usually follow swept over the land, than up springs the bramble, either blackberry or raspberry or both, and in a very few years what has been left by the woodsman and abandoned as worthless, becomes a natural fruit garden, loaded with a crop which, if gathered and marketed, would realize a greater profit than lumber, with far less labor and outlay of capital. The careful farmers that live adjacent to our lake harbors, and some of the inhabitants of our cities and villages, avail themselves of the blackberry harvest; but there is good reason to believe that, although several thousand dollars' worth are annually harvested and marketed, the crop gathered bears a very small proportion to the crop produced.

The Wintergreen.—Of late years that beautiful, aromatic, red berry, so common in Michigan, known as the Wintergreen, has gradually found its way to market. It is believed to be valuable for its medicinal as well as its dietetic qualities, and its more general use would be productive of public health. It is eagerly sought for by children, and is a favorite fruit with all who are acquainted with its virtues. The peculiarity of the wintergreen is its preservation during the entire winter season, when covered with snow, and its freshness in early spring, before any fruit or vegetable has been produced. A recent writer has said in regard to the wintergreen:

"For while it is so beautiful
  With scarlet berries bright,
It's covered up beneath the snow
  All winter out of sight;
And in the spring, this little thing
  Just peeps above the ground,
And children run and gather it
  And find it sweet and sound.

Thus every season has its fruits,
  From early spring till fall,
And even winter can't be said
  To have no fruit at all:
For if we only take the pains
  To dive beneath the snow,
We find, bright red and crisp and bright,
  The wintergreen below.

The Wild Grape.—Speaking of the French voyagers and their explorations of the river Raisin, Hon. Edwin Willets of Monroe says: "At intervals the wild, unbroken forest came to the water's edge, and cast the shade of giant trees into the river; and everywhere, in the wildwood and in the glade, on the river's edge, and as far away under the over-arching trees as the eye could see was a wealth of grape-vines. Everywhere hung clusters of rich purple fruit; everywhere, with a wild luxuriance that far surpassed the stories their fathers had told of the vineyards of sunny France. Within the present century, from a point near the foot of the street on which this building stands (in Monroe) to where the mill-dam has been placed, a man, now living, walked and climbed the whole distance, over 80 rods, on grape-vines, climbing from tree to tree without touching the ground. No wonder these warm-hearted, enthusiastic voyageurs, as they paddled along up the river, cried out, 'Le raisin! Le raisin!' (the grape! the grape!) and that they then named the beautiful river as they did, "La Riviere au Raisin." The wild grapes, although now superseded by cultivated varieties, as a general rule, are still highly prized, especially for wine; and in the season of 1875 they were the only varieties in the Northwest that sufficiently matured for that purpose.

The Wild Nuts.—Of the nuts of Michigan all are good, but on account of its extensive growth the Beechnut, perhaps the least prized, is, I think, on the whole, the most valuable to the State. The year 1875, so disastrous for cultivated fruits, was remarkable for the quantity and superior quality of its beechnuts. Farmers usually allow the hogs to harvest this crop, and even for hog-feed it is a profitable crop.

In replanting trees for shade, wind-break, or ornament, if our valuable nut-producing trees were selected, we should not have to regret the diminution in the production of nuts, caused by the destruction of our forests for timber. Butternut, walnut, and chestnut are as good for shade and ornament as maple, or nearly so; and the production of nuts, and their greater value for timber, render them more desirable.

The Berry Crop.—The natural production of berries in Michigan is, however, the principal feature of the subject of interest to farmers, as indicating, with the utmost certainty, what may be relied upon as the fruit crop of Michigan. For thousands of years, probably, this territory has produced annually its crop of berries, and in all that long period no reverse of season, no severe winter or dry summer, has exterminated the cranberry, the huckleberry, the raspberry, or the blackberry, establishing the fact beyond a question that our soil and climate are peculiarly adapted to the production of this class of fruits. And, amid all the reverses of fruit-growing incident to the introduction of exotics, it will be found that the fruit-grower who has followed the teachings of nature, and planted most largely of the berries, has succeeded best in establishing fruit-growing on a permanent and reliable basis. Michigan is naturally a berry-producing State, and while every effort to introduce exotic varieties may

be laudable, in view of the general interest, farmers should rely mainly on crops which the experience of the past proves to be as sure as ordinary farm crops.

Introduction of Exotic Fruits.

The first planting of fruit-trees by man, of which we have any record, appears to have occurred about the year 1705, as in 1805 there still stood and flourished a pear-tree near the Detroit river which was then said to be 100 years old. From this tree Francis Navarre transplanted two sprouts, which grew to be productive trees. The belief is that the pear was originally imported from France, and it is reported that three pear-seeds originated the celebrated old pear-trees along the banks of the Detroit river, and that these seeds were brought over by a French immigrant in his vest pocket. But, however the introduction of foreign fruits commenced, it is most probable that the early French traders and missionaries imported them and planted them at their various trading-posts and missionary stations along the Detroit river, at Monroe, at Old Mission, New Mission, and other points in the Grand Traverse region, and at Mackinaw. Not only pears, but apples still flourish at these points, and, although but little cultivated, these trees are still productive; and when taken in hand by skillful cultivators, as is usually the case, their youth has been renewed and they have become profitable trees. Many of these trees were planted during the last century. Both the apple and pear-trees are healthy, and still bear from thirty to fifty bushels in a season. They appear to be as hardy as the forest trees, and have become thoroughly acclimated.

Early Orchard Planting.

The first extensive orchard was probably that planted by Governor Wm. Woodbridge, consisting of two thousand apple and pear-trees. It was on his farm west of Detroit, and now absorbed by that rapidly growing city. These trees were planted in 1825, so that orchard planting in Michigan may be said already to have attained to the dignity of half a century, although the largest portion of it has been done within the past 20 or 25 years. Orchard planting, as a part of the agriculture of Michigan, has been more or less pursued ever since the time of Governor Woodbridge. Almost every farmer who could pay for or get trusted with fruit-trees, has planted an orchard; and in many cases when the time has come around to pay off the last installment of the farm mortgage, the sale of fruit from the orchard has been the source from whence the money was obtained. While this has been the case generally throughout the State, that farmers have made fruit-growing simply an incidental feature of their agricultural operations, and usually subordinate to their general farming, there are counties in the State that, owing to their peculiar fitness for the business, nave made fruit-growing a specialty, and in some a leading feature.

Apples a Specialty.

The production of apples in Michigan has been a special feature in the counties of Oakland, Lenawee, Jackson, Hillsdale, Branch, Calhoun, Macomb, Livingston, Washtenaw, Wayne, Van Buren, Shiawassee, Monroe, Lapeer, Kent, Ionia, Ingham, Genesee, Eaton, Berrien, Kalamazoo, and Allegan, as the orchards in those counties, many of which were planted thirty, and some forty years ago, are now in good bearing condition. There are other counties rapidly coming into prominence as apple-growing counties, among the most promising of which is probably the county of Grand Traverse, where apples have

been extensively planted within the past ten years, and the quality of the apples produced near Traverse Bay is unsurpassed.

Peaches a Specialty.

Peach-growing, as a specialty, commenced in Berrien county in 1835, and the first exportation of peaches took place in 1840, from the harbor of St. Joseph, in that county.

The enormous prices obtained by Capt. Boughton, the pioneer in this business, for Michigan peaches in Chicago, sometimes as high as $45 a barrel, stimulated peach-growing in the St. Joseph region, and in ten years Capt. Boughton's shipments alone amounted to 10,000 baskets. Although Berrien county has kept the lead in the production of peaches, the counties of Van Buren, Allegan, Ottawa, Kalamazoo, Kent, Muskegon, and Oceana have planted largely of peaches, and have competed with Berrien for the honor and profit of peach-growing. In small fruits, grapes, strawberries, raspberries, and in all other fruits except apples, Berrien county also takes the lead of all other counties, and may be said to have made fruit-growing the leading interest of the county.

II. ITS PRESENT STATUS.

Since the disastrous winter of 1875, which affected the fruit trees not merely of Michigan but of all the Northwestern States, fruit-growing as practiced by horticulturists has received a shock that it will require several seasons to recover from. Previous to that disastrous period, in the winter of 1873, it had also sustained severe drawbacks in various parts of the State; but the cold of one year ago affected even the lake-shore region, owing to the generally accredited fact that Lake Michigan was actually covered with ice, and the usual protection afforded by open water was for a time withdrawn, and the lake shore was no better than fifty miles inland, so far as lake protection was concerned. This unusual, and, as we believe, unprecedented occurrence, causing the destruction of a large proportion of peach trees, and of not a few of other fruit trees, naturally discouraged and greatly inconvenienced fruit-growers, especially those whose almost sole dependence was on the peach, the pear, and similar exotic fruits. But those fruit-growers who have made small fruits their specialty, or who have had the precaution of adopting mixed husbandry in regard to fruit, have only regarded the calamity as incidental and temporary, and move along in the even tenor of their way, almost undisturbed.

The Census Returns.

The census of 1874, taken by State authority, showed that there were 237,098 acres of land devoted to orchards; 1,029.64 acres to vineyards; 947.52 to raspberry canes; 1,648.32 to strawberry plants; 387.37 to currants and gooseberries, and 8,421 to melons and garden vegetables, making the total number of acres devoted to horticulture 249,532.85. And this, the work of less than 50 years, with a population of, for most of that period, less than one million, on a territory capable of sustaining in comfort at least twenty millions. The proceeds or annual receipts for the produce of this land in 1872, is given as $3,537,519; and in 1873, the year of disaster next preceding the last, it was not less than 3,386,866. It is not expected that these figures are absolutely correct, as those who have ever tried to collect statistics of this character well know it is impossible to more than approximate the amount. But these figures are sufficiently accurate to show that previous to 1875 the fruit interest, notwithstand-

ing the disaster of 1873, had attained very respectable proportions, and fully justified the State in making an effort to obtain returns on the subject. The object of taking the returns for two years, which does not seem to be understood by the compiler of the census, who complains of the extra labor it occasioned and the difficulty of obtaining accurate returns for 1872, was to show the effect of the severe winter of 1873 on the succeeding crop. At the time the census law was amended so as to include fruit returns, the legislature had just experienced at Lansing one of those severe frosts which, to persons coming out of the heated atmosphere of the State capitol, appeared to take away the breath. Thirty degrees below zero had several times been reached, and the horticultural members of the legislature well knew that the crop of peaches and of some other choice fruits would not be a fair average the coming season; so, in order to make the returns of fruit of any value, the crop for 1872 was included. That crop was, perhaps, as nearly an average one as could then be obtained, and although made up, in a great measure, from the imperfect memory of farmers, offer us some basis of comparison.

Table showing the Effect of the Cold Winter of 1873 on the Fruit Crop.

FRUIT.	1872.	1873.	Difference.
Apples	7,243,146 bu.	5,928,275 bu.	1,319,971 bushels less.
Peaches	318,554 "	22,069 "	296,485 " "
Pears	33,932 "	40,857 "	6,925 " more.
Plums	6,301 "	3,667 "	2,634 " less.
Cherries	60,958 "	66,746 "	5,788 " more.
Grapes	23,235 cwt.	29,601 cwt.	6,366 cwt. more.
Strawberries	50,420 bu.	48,922 bu.	1,498 bushels less.
Currants and Gooseberries	36,484 "	40,562 "	4,078 " more.
Vegetables	685,904 "	930,686 "	244,782 " "
Value	$3,537,519 00	$3,386,866 00	$150,653 less.

From this table it will be seen that the principal loss occasioned by the severe winter of 1873 was with the apples and peaches, while pears, cherries, grapes, currants, and gooseberries showed a positive increase that year over the crop of the preceding year, and so did melons and garden vegetables. Strawberries, however, suffered a decrease from winter-killing of the plants. The loss on apples and peaches was very great, and so great on peaches as to amount to a failure, except in Berrien, Allegan, and Van Buren counties. Van Buren was that year the banner peach county, having produced 9,072 bushels, against 6,230 in Allegan, and 2,357 in Berrien. This would seem to justify, in a measure, the claims of our South Haven friends as to their favored location.

This table also shows the important fact that a winter, however severe, does not necessarily affect grapes, currants, and gooseberries. Had raspberries been specified, it is probable it would have shown them also but little affected. The fact that after the still more severe winter of 1875 the grape crop failed for the first time in Michigan, does not change this view, because it is well known that much of that failure was owing to the unusually short summer rather than to the severity of the winter. The grapes were grown, but failed to mature.

This table also shows that notwithstanding the great loss on apples and the still greater failure of peaches, the loss was nearly made up by an increase in

other crops, showing, what should always be insisted upon with those who depend on fruit-growing for a living, the importance of mixed husbandry.

Effects of the Season of 1875.

The destruction of peach and even of apple trees by the extraordinary season of 1875 will undoubtedly lead to the adoption of mixed husbandry in fruit-growing, and this can be done by the substitution of small fruits for the trees destroyed, so that in a very few years the annual product will reach its former and even greater proportions.

While peach-growing in the lake-shore counties will still be, as it is being, ardently pursued by intelligent cultivators who will receive higher prices in consequence of diminished production, the fruit-growing interest is rapidly gaining, from the experience of varied seasons, that solid basis which will make it one of the permanent and profitable interests of the State.

III. ITS PROSPECTS.

This leads me to the third and last branch of my subject. The prospects of fruit-growing in Michigan, although not equal to what they were before our recent disasters, are nevertheless good. The intelligent fruit-grower will adhere to his profession with strong faith. The careless grower will become more careful or abandon the business, leaving it better for those who pursue it with diligence; and on the whole, I predict for fruit-growing in Michigan a brilliant and a profitable future.

Economy of the Fruit Business.

To make fruit-growing profitable, however, cheaper transportation to market must be secured. Every operation must be conducted with economy and prudence, and the business must assume the solid, substantial character at which the production and marketing of other farm crops have long since arrived. Why it should cost ten times more to transport fruit across the lake than it does other farm crops, must be explained by our transportation companies, or the fruit farmers will have to become their own common carriers, or, what would be still better, keep their produce for canning or drying, in preference to paying unreasonable rates and submitting to extortion. If the producer would hold his fruit for sale on his own farm, and the commission merchants had to pay for transportation instead of the fruit-grower, transportation companies would soon be compelled, by the united influence of the trading community of the large cities, to place fruit on a par with other staple productions as to cost of transportation, and give the fruit interest a fair chance with the other producing interests. This state of things arrived at, and it is reasonable to believe that fruit-growing will rapidly assume its position as one of the staple productive interests of Michigan.

After the reading of Mr. Clubb's essay was the following

DISCUSSION.

Wm. Cumming of Saugatuck.—Mr. Clubb, the author of the paper is not present, but I would like to know if the statistics in regard to the shipment of fruit were taken from the shipping books of the warehouses, or gathered from the farmers? I saw a statement in some of the Chicago papers that South Haven was not only credited with her own shipments of peaches, but those of Saugatuck also, for that year.

N. W. Lewis.—I think Mr. Clubb is mistaken in regard to the extreme cold weather of 1875 covering the lake with ice so that the lake exerted no influence upon the temperature. For instance, the 9th of February was the coldest morning. February 16 was another very cold time, but not as cold as the other. Near the lake the thermometer marked two degrees above zero, while at a distance of sixteen miles away from the lake it stood at sunrise from eighteen to twenty degrees below. This shows that the lake shore did receive an influence from the lake at that time, although it was two weeks after the extreme cold morning.

A. S. Dyckman, South Haven.—I cannot state definitely as to how the figures were obtained in regard to the peach crop of 1873, but I believe it was done under State law, by the officers who took the census of the other crops. It certainly was not taken from the shipments to Chicago or from any port in Michigan. In reference to the lake being frozen over during last winter, I am inclined to doubt that. I believe there was no time during the winter of 1875 that we did not receive some protection from the lake. In Allegan and Van Buren counties I had opportunities for carefully observing it more than anywhere else. The extreme cold of Feb. 9 was unprecedented, and even then there was something of a lake influence, from the fact that the thermometer on the lake shore marked from 14 to 20 deg. below zero, while we know at Grand Rapids it went below 40 deg., at Kalamazoo 30 deg., and at Allegan 34 deg.

WEDNESDAY FORENOON.

On the meeting being called to order, it was found that Mr. Blair of Martin, one of the essayists, was absent, and Prof. Kedzie was requested to occupy the time, which he did by giving an address on "Lightning Rods." Immediately after, and in the regular order of the programme, the Professor gave his lecture on "Muck." Both of these lectures, and discussions on the same, are given in full, following this record of the Institutes.

Next on the programme was Mr. Julius Tomlinson of Allegan, who, being called upon, read the following essay, entitled

SHALL FARMERS KEEP BEES?

Should we be told to-day that some article of value existed all around us, and that it could be had freely for the gathering, there would be, I apprehend, some curiosity to know of this article. And should we have the further information that plenty of laborers could be obtained to gather this article, and bring it to our very doors, and put it into the most beautiful and convenient forms for sale or use, the curiosity would doubtless increase. And were we further told that those laborers worked without wages, seven days in the week, and from dawn of day till dark, there might be some excitement on the subject.

In the development of vegetable life, one of its most beautiful processes is the opening of flowers. In the heart of flowers is distilled the nectar that we call *honey*, and it is this article of value just alluded to.

In the development of animal and insect life, which exists all around us in wonderful profusion, we have the insect that we term the Bee; the instinct of which is to gather this honey and store it away for present and future use. The bees are the laborers of which I have spoken.

And, now, what is honey? It is not necessary to define the term in scientific language. It is sufficient to say that is a very desirable sweet, gathered by bees from flowers. It is stored by them in tubes of wax of purest white, and is not only beautiful to look upon, pleasant to the taste, and a graceful addition to the pleasures of any repast. It is relished as an article of food by nearly every member of the human family, and has been held in the highest estimation from the earliest ages to the present time. Allusions to it are frequent in profane and sacred writings, and I will digress for a moment to allude to some of the latter.

When the patriarch Jacob desired favors of the ruler of Egypt, he said to his sons: "Do this: carry down the man a present, a little balm, a little *honey*, spices, and myrrh, and almonds."

The psalmist David, in the nineteenth psalm, speaks of the "judgments of the Lord as sweeter than honey and the honey-comb;" and when Solomon would find a fitting simile for "pleasant words," he says that "they are as an honey-comb, sweet to the soul."

It is said of John the Baptist that his food was "Locusts and wild honey;" and as it is recorded by the Evangelist Luke, the last article of food eaten by our Lord, and just before his ascension into heaven, was a piece of honey-comb.

Honey exists all around us. It lies in tiny drops in the folds of nearly every flower. It is probably much more abundant than we are aware of, although many apiarians maintain a contrary opinion. But it is my belief that there are but few localities, at least in this State, where there is not honey enough to supply a few swarms of bees on every farm.

And what are bees? I need not define by the terms laid down in the books. They are sufficiently well known for all practical purposes. Bees are the agents, and the only agents, by which honey can be obtained. They work with prodigious energy and industry, and when honey is abundant, they will store it in almost incredible quantities, and when suitable room is provided, they will store a handsome surplus for their owners. Besides this, they have the instinct to increase and form new colonies or swarms, and any kind of a box, or hollow log, or barrel, if it be clean, and free from offensive odors, will be accepted by them as a home. They are democratic in their tastes, and are perfectly indifferent to the beauties of rural architecture. So that no farmer need hesitate about keeping bees on account of hives. Any old box will do, though it is not the best by any means. Of the profits of bee-keeping in proper hands, with good hives, and in good locations, and with every condition just right, there can be no question. Now, given honey in abundance, bees enough to gather it, and it would seem that bee-keeping must be for the farmer a very attractive pursuit. Bees work early and late. They fly at will over hill, and valley, and plain. They gather only what would otherwise go to waste. They enrich themselves and their owners, and impoverish no one. They are, moreover, very useful in the fertilization of flowers. It would seem, therefore, that the farmer has every incentive to become a bee-keeper; and so he would have were there no dark shade to this otherwise fair picture. I am here to answer the question, "Shall farmers keep bees?" I am, in one sense, on the witness stand, and it is incumbent on me to present both sides. I cannot, in truth, plead entire ignorance in the matter of bee-keeping, although the more experience I have the more I am convinced that I stand only on the threshold of the science. The labors of agriculturists have done more in the last quarter of a century to unfold the mysteries of the bee hive than has been done before since the world began; yet it

is my belief that as deep, if not deeper, mysteries remain to be unfolded. In what I have already said, I have presented bee-keeping in its best aspects; I would that I could stop here. But you would not be satisfied were I not to answer the question, What are its drawbacks? Why cannot every one realize to the fullest extent its pleasures and profits? What are the hindrances that the bee-keeper has got to meet, whether he will or not?

1st. Bees are armed and equipped as the law directs, and ready at all times for defensive and offensive war. It needs no detested conscription to drag them reluctantly to the fray, and when, for any cause, offended, they are more to be dreaded than the fabled Furies. To some, a bee-sting is a very serious matter, and a single sting has sometimes produced convulsions, and even death. And with the most experienced bee-keepers, accidents will happen which makes it very difficult and dangerous to manage them. Unless bees are kept well out of the way there is always danger. A sweaty horse is very offensive to them, and there are many instances where valuable horses have been stung to death. The greatest care is always necessary in handling them, for if once offended they remember it for a long time.

2d. The bee moth. This is a winged insect, the larvæ of which lives in the combs, and consumes the wax; and when in sufficient numbers, destroys the colony. The moth is always present. There is no getting rid of it entirely. The bee-master must exercise unceasing watchfulness, or his bees will be ruined. It is like a besetting sin, ever ready to take advantage of any weakness on the part of the bees, or neglect of their owners. Although the skillful bee-master can keep them in check, still they must ever be considered a formidable enemy.

3d. Foul brood. This is a disease peculiar to bees, and, so far as I am aware, is incurable. Some may think that I need not refer to this disease, as it has never yet prevailed in this State so far as I know.* But it exists in other States, and with the present recklessness of bee-keepers in buying and selling queens and bees, it is liable to be introduced into any apiary; there is no help for it, except by fire and brimstone. It is one of the risks that must be taken into the account in investing in bees.

And 4th. All of the drawbacks that I have named dwindle into insignificance when compared with the overshadowing calamity now upon us, and which, for want of a better name, we call the dysentery.

This has prevailed only a few years, yet it has spread all through the northern States, and I think I am safe in saying that over fifty per cent of all our bees perish every winter and spring with this disease. Oftentimes large and prosperous apiaries are destroyed by it. As yet there is no remedy. So fatal is it that Mr. T. F. Bingham, one of our most skillful apiarians, has incurred the heavy expense of moving all his bees to the State of Tennessee, hoping thereby to escape. All of our bees that do not perish, no matter how wintered, come out in the spring so weakened that it requires the utmost skill on the part of the bee-keeper to bring them up into working condition. Of the fifteen swarms that I had left last spring, over half failed to be prosperous for the whole season, and yielded no surplus honey. I think I do not err when I say that of those who had bees five years ago, seventy-five per cent now have none. If no sure remedy for this disease is found, we may as well give up in despair.

There are other drawbacks, such as parasites, loss of queen, excessive swarming, king-birds, toads, etc.; but I will not dwell further on the drawbacks to

*Since reading the above, Prof. Cook informs me that it has prevailed in this State, doing heavy damage.

bee keeping. I have now presented both sides of this interesting subject, and I leave for you, each for himself, to answer the question, "Shall farmers keep bees?"

I will only say in conclusion, that among the requisites of a successful bee-keeper are undoubted courage, steady nerves, a fair share of mechanical skill, habits of close observation, orderly, and prompt to do the right thing at the right time, and in the right manner; and above all an unflagging enthusiasm in the calling. If any one feels that he has these requisites, and has the heart and the purse to take the risks of the drawbacks that I have mentioned, I would say invest in bees. If not, he had better buy his honey at one dollar a pound.

Mr. Wm. Cumming of Ganges was next called upon, who read the following essay on

LONG-WOOLED SHEEP.

One advantage that sheep possess over other varieties of stock is that the carcass can be disposed of for mutton at any age, and costs no more to produce than other kinds of meat, while the fleece will usually pay all the cost of keeping; and as both items, the wool and the carcass, are sources of profit, both items demand the attention of the sheep-breeder. The sheep that will combine in the same animal both these qualities in perfection is the sheep demanded by the farmer. While the Merino, as is generally acknowledged, has the superior claim in respect to one class of wool, I shall endeavor to show that the Cotswold, Lincoln, and other long-wooled sheep have claims which should not be overlooked by the farmer. I am satisfied that the wandering Merino, weighing one hundred pounds, will consume about as much food as the lazy Cotswold weighing 200 pounds; also that the long-wooled sheep are the most profitable, especially on low lands where there are coarse grasses. They are just the kind to improve such lands. They will thrive on rank, coarse food, bringing in white clover, and doubling its value in a short time. In regard to my experience since I have lived in Michigan: I commenced with two ewes and two lambs. The ewes were in very low condition, and one showed symptoms of illness; but they were the best I could get. The ill one died, leaving me with but one ewe and the two lambs; the lambs did well, but the old ewe never bred after I got her. She throve well, and got very fat. I kept her two years and butchered her, and she dressed 112 lbs. The first year I do not remember the amount of wool, but the second year I sheared 24 lbs. When it was washed and carded I had 18 lbs. of rolls which made 17¾ lbs. of yarn. This, at $1 25 a pound, would amount to $22 29, or $7 43 per sheep. Deduct 25 cents per pound for carding and spinning, and you have $17 75, or per sheep, $5 91⅔. The two young ewes had a lamb apiece, which were worth at least $3 each, making $8 91 the product of each ewe that year. The next year I had seven fleeces, which gave me 50½ lbs. of clean wool which I sold for $25 32; and I raised six lambs from four ewes, which, at $3 apiece, would be worth $18, making the total $43 32, which I think is doing as well as any short-wooled flock of equal number; and if sold, they would bring three times what Merinos would. I feed clover hay, cut when in full bloom, and cured in the cock. I have fed a little corn, but find that it has a tendency to loosen the wool. Peas are the best grain. I do not intend to feed any grain this year. I shall depend on hay and roots. I have never found any difficulty in bringing my sheep through the winter in good condition. In breeding, I find by observation that lambs dropped in March or May are

stronger than in April. The cause I attribute this to is, that eating old grass with new irritates the bowels, producing a slight diarrhœa, weakening the ewe, and hence weakening the offspring.

Mr. Cumming exhibited a sample of the wool of his Cotswold sheep, it being very long, soft, and glossy.

DISCUSSION.

Mr. Munger.—Are not long-wooled sheep more liable to be troubled with ticks than the fine-wooled?

Mr. Cumming.—Did you ever see a good, fat sheep struggling with ticks?

Mr. Munger.—I have; the Cotswold you are speaking of.

Mr. Cumming.—I know that poverty will cause ticks to work.

Prof. Fairchild.—The Cotswold have been kept at the college for years, and we have also a fine Lincoln ram.

Mr. Cumming.—Don't you consider the Lincoln superior to the Cotswold?

Prof. Fairchild.—He certainly is superior in appearance.

Mr. Cumming.—I have never owned any Lincoln sheep myself, but some friends of mine living in Canada, who were among the first importers of long-wooled sheep to America, have discarded all varieties except the Lincoln.

S. R. Lewis, Ganges.—Is the fibre of the Lincoln wool finer or coarser than that of the Cotswold?

Mr. Cumming.—It is finer.

Mr. Warner.—Does the gentleman regard Allegan county as a favorable place for sheep-raising?

Mr. Cumming.—I live within a mile of the village of Saugatuck, and I don't consider it good for the Cotswold. My sheep have been afflicted with a sort of catarrh, or running at the nose. Whether it is caused by the dampness off the lake I am unable to state. I have tended sheep since I was twelve years old, and I never saw them so universally affected with this catarrh as in this county. Still, they seem to thrive pretty well. I have noticed, also, that when my sheep get to be five or six years old their wool gets thinner. Whether it is the climate or soil I am unable to state.

Mr. Munger.—Is your land sandy?

Mr. Cumming.—Mostly a sandy loam. In the summer time my sheep have the run of a partially cleared portion of my farm. Part of it is what might be called low ground. I claim that sheep want water just as much as a horse or any other animal.

Spencer Marsh, Allegan.—I would like to ask the gentleman if he does not think all sheep do better in a dry atmosphere?

Mr. Cumming.—I think they do.

Mr. Loomis.—I would like to inquire if the gentleman has ever examined to see if there is not some vegetable, such as Johns-wort, growing upon his soil, which may affect his sheep?

Mr. Cumming.—I have never discovered anything of the kind.

J. A. Anderson.—Do you consider the Cotswold as hardy as the Merino?

Mr. Cumming.—I can hardly answer that question. I know I never saw sheep troubled with the catarrh until I came to the lake shore.

Mr. Pratt, Allegan.—The Merinos are just as much afflicted with it as the Cotswold. I lay it to the dampness. I know there are a great many people troubled with the catarrh on the lake shore.

Rev. Mr. Crawford.—I have been afflicted with catarrh a great many years, but the two years I resided at St. Joseph I suffered less from it than I had in twenty years.

At the close of this discussion the meeting adjourned until 2 o'clock P. M.

THE AFTERNOON SESSION

Was opened by Prof. A. J. Cook, who delivered the following lecture, entitled

FRUIT OR INSECTS—WHICH?

I have no question that, were I gifted enough to correctly state the annual loss to our State and country because of insect depredations, I should find few of you sufficiently credulous to accept my statement, though all of you have too good reasons to expect large figures. Some of our productions, for instance our plum crop, have been generally given entirely over to our enemies, and hence are little thought of. Other of our crops are so constantly raised on thirds, the insects taking one or two-thirds, that we have ceased to possess any idea of a full yield, and so take no heed of our loss. Still other of our products are cut off, withered, or dwarfed. and the cause is like the wind; we see the effects thereof, but know not whither it cometh. Hence it is that nearly all, even of those most closely interested, have no conception of the magnitude of their losses from these causes. Why, take the apple tree and its product right here in our State; I know of no less than six insects which seriously affect its vigor by despoiling it of foliage; four are engaged with too good success in hastening death by mining the trunk; at least two are sucking the vital fluid from the roots, while no less than five are demonstrating, by actual works, that they appreciate good apples, and mean to gratify their appetites, man's interest notwithstanding. Seventeen on one. Is n't it time to demand fair-play? I have no doubt that could we rescue the spoils from all our insect banditti for three successive years, they would more than cancel our national debt. Surely such a statement ought not to be received with indifference, nor will it by the thoughtful and enterprising. That was rather a startling remark which was made by one of our country's wisest pomologists at the recent meeting of the Ohio Horticultural Society at Toledo, that it is a fact already patent to the far-seeing, and would soon be generally accepted, that the best success with all our fruits, even apples, demands the planting of a succession of orchards. I at once thought that proper attention to this insect question would greatly broaden the intervals of planting. Many orchards in our State have gone on giving ever-increasing returns for fifty years, and single trees for more than one hundred years. Nor need we doubt but that, with wise precaution, such experience may be oft repeated.

But it is often asked: What does this important question demand for its solution, and has past experience given us any hope that it may be solved? I briefly answer: Earnest, persistent study and research by the most capable men; and secondly, that our practical men, those directly interested, should *all* take "the bull by the horns." In other words, that there should be such interest elicited, through grange and club, that every man in every neighborhood of our State should give battle in lines already marked out, and adopt new ones or better ones so soon as they were suggested by the investigators. As well say that all the children of a neighborhood would be gentle, courteous, and beautifu

in heart and soul, because one man gave good and wholesome training, as to say that insects could be kept at bay without concert of action. Suppose one farmer in a community instils into the lives of his children correct moral principles, will that insure the safety of his apples and melons? To be sure his property would be safer even for this wisdom. No more can the codling moth or curculio be exterminated by one man, though his own persistent action would benefit himself and even his neighbors. No; the means must be generally made known to all our farmers and fruit-growers, and then all must be fired with such zeal that practice may keep pace with knowledge.

But have we any results that show that such a course will bring us respite from these thousand ills which waylay us on every hand? I am most happy to state that such are by no means isolated.

It was found by our fruit men of the peach-belt that unless the peach-borer was fought to the knife, this important interest would prove a failure. The trees would all be speedily killed. It was a case of life and death. Sluggish humanity woke up. Everybody rushed to the fight, and the beautiful peach orchards flourished. Now for the sequel: The peach men now tell us that this enemy gives very little trouble. In the same region the curculio, which had utterly whipped us out in plum culture, driving us from the field and taking undisturbed possession, came all undaunted, flushed with success, and cried surrender to the peach men. The latter, armed with chips, mallets, one and two-wheeled artillery, soon brought the little Turks down. "That bright dream was their last;" and now the fruit men tell us they have no fears of the curculio, and more, that these little snout beetles are yearly growing less. Dr. Trimble and a live farmer's club so aroused the people of Vineland, New Jersey, to action that the fruit and region have gained a high reputation as being void of insects. The old mission people up on that favored peninsula at Traverse demand, and, I understand, enforce their edict that all shall enlist in the insect battle. If such action does not attract a society worthy their climate, soil, and position, then the future cannot be judged by the past. In fact, the whole lake shore is giving us lessons on this subject, for which she deserves a hearty vote of thanks. Had I time I could give many other examples, both from home and abroad, that fully sustain the position that real, earnest, persistent effort, and that, too, right in the line of the fullest pocket,—the best financial prosperity,—is all that is required to rid us of those foes that require so large a share of our gains, and often make us look sad and discouraged in view of our prospects.

That our pomologists may have the less excuse for that unpardonable neglect that robs themselves and curses their neighbors, I propose to give directions for the care and management of our various orchards, pruned of all matter foreign to the subject, from the standpoint of Economic Entomology, the course of procedure for the year which is demanded by the best success. First, then, I will give directions for the treatment of

The Apple Orchard.

Nothing is more essential—and this will apply to all orchards—than to keep the trees vigorous. It is the feeble frame that is most susceptible to disease, and that first succumbs; hence thorough and persistent culture, and suitable and sufficient fertilizers, should never be neglected. The seeding down, especially of young, growing orchards, is sure to be followed by a raid from the most destructive insects. Neglect or overcropping will end in the same misfortune.

Before the middle of May the rough bark should all be carefully scraped from

the trunks and main branches of the trees. This may be done when leisure or time will best permit, except it were better that it be left till the severe cold of winter has passed by.

The first week of June the trunks and main branches of the trees should receive an application of soft soap, which ought to be repeated, especially if the trees are young, the first week of July. This substance may be applied with a brush or broom.

In May and August certain insects will spin webs in the trees. These should never be allowed to remain. If examined in the middle of the day they will be found to contain "worms," the larvæ of moths. If on the end of twigs they may be cut off and burned, or, wherever they be, they may be crushed with the hand, in which case an old buckskin glove may be worn. If not done in the middle of the day the insects may be out of the web feeding upon the foliage, and thus escape. The orchardist should be on the watch, so as to eradicate these pests at the first onset.

On or before the 20th of June, bands made of coarse or old woolen cloth, and about four inches wide, should be wound about the tree and fastened with a single tack. Coarse paper or thin wood, such as is used for berry boxes, may replace the cloth, yet the paper is not as good. The bands need only be long enough to lap sufficiently that a tack may secure it about the tree. These bands are not to be put on any trees that have no fruit on them. By the 10th of July some of these bands which surround trees which yield the earliest fruit, as the early harvest, for instance, should be examined. This may be done by drawing the tack, which is never driven quite to the head, with a small tack-hammer, which, for convenience, should be suspended by a cord which surrounds the neck. If small "worms," such as are often seen in the fruit, or small silken cocoons, which contain the pupæ of the same insect, are found, these should ALL be crushed with the thumb, and the cloth band adjusted as before. All the bands should be thus examined every ten days till the first of September, when the work may be discontinued till after the apples are all gathered, when the bands should be again examined and the insects destroyed. If the bands on the earliest apple trees are found to contain no insects on the 10th of July, the examination may be discontinued till the 20th, and then examined as before explained.

Rooms where apples are kept in summer and autumn, and cellars where they are stored in winter, should be absolutely tight, so that no insect, however small, could possibly escape; and from May to July these should be kept constantly closed. If ventilation is desired in these rooms, it may be secured by putting screens of fine wire gauze in the windows.

During the months of July and August the twigs of the apple trees may become blighted. If such is the case, let there be a close examination to determine if the twigs are tunneled or any insect is found therein. If such is the case, let the twigs be cut off and burned.

In August and September the trees should be closely examined, that we may learn whether or no the borers are at work, This is especially desirable with young trees. If a dark spot appears, caused by discolored bark, through which an opening is seen with a sawdust-like material protruding, then with a sharp knife, and wire rather small, not very flexible, and with a handle, either cut till the borer is found and crushed, or else crush by working the wire in the chamber, when it is thought the amount of cutting necessary would injure the tree.

The amount of labor required to do as above recommended is not very great,

and will almost ensure a vigorous orchard, and a fine yield of most fair and beautiful apples. A gentleman living in Washtenaw county told me, the other day that from seven and one-half acres of apple orchard he took, the past season, 800 barrels of apples, which sold for $2 00 net, per barrel. Thus the net receipts per acre were $213 33, while for the 7½ acres they were $1,600 00. Do not such returns warrant some care and labor? In fact, few manual labor pursuits will pay better in our State than the production of apples; and in no State are the inducements greater to plant large orchards, and give to them every needed attention, that we may maintain our present justly earned reputation of being the first apple State in the Union.

The Peach Orchard.

It is pleasant to advise in the management of the peach tree, for a fruit so delicious and so valuable will certainly be preserved, if the knowledge is sufficient to accomplish it.

In September the peach-grower should dig about his trees, close to the trunk, and if he finds lumps of earth, chips, and peach gum just beneath the surface, he should find out the borer in the tunnel or wound of the tree, and crush him. The gummy mass leads to a quick discovery, and the labor is so light and so remunerative that it were well to go over the orchard in the same way the next season, in April or May, so soon, indeed, as the ground is suitably dry, to enable one to work it pleasantly. In early May tin bands, three inches wide, should be tacked around the tree with a single tack, especially where the soil is light. These bands will keep the cut-worms from reaching the branches and cutting off the buds. Such treatment is also desirable in almost all our orchards, and even in vineyards.

In May, too, so soon as the peaches have set, the curculio must be fought. This advice will apply equally well to the plum orchard. And what a loss, not only in luxurious fruit, but also in cash, results from this neglect of the plum orchard in our State! Instead of raising no plums, we might as well, and at slight expense, raise thousands of dollars worth annually.

In the first place, keep all grass and weeds away from under the trees: that is, practice perfectly clean culture. This is desirable the season through, but imperative in May and June, would we subdue this foe of our two most luscious fruits in the most economical manner. As soon as the plums or peaches are formed, place two chips, or pieces of oak bark, with the smooth surface down, immediately against the tree on opposite sides, and flat on the ground. Now the curculios are nocturnal, and do their wanton business by night; and until the cool days are past, or along into June, will come down from the tree by day and hide under the nearest screen. As the chips are so convenient, they are of course appropriated. These little pilferers will lie thus concealed till towards nightfall, when they again betake themselves to the trees to repeat their work of pillage and destruction. Now it is easy to take them from under the chips, and thus cut short their evil work. The capture is most cheaply made by boys, as follows: With a vial in one hand, stopped by the thumb, they turn the chips over, pick off the weevils and put them into the bottles, thus carefully collecting from under all the chips of the orchard. This gathering should take place before four o'clock, or some of the curculios may have gone from the chips to the tree, and thus have escaped.

In June, when the days begin to get hot, the little "Turks" will not leave the trees even by day, yet if the trees are suddenly jarred as by a sharp blow,

the curculios will then fall to the earth. Hence we have only to put a sheet under the tree, strike the tree with a mallet, and gather up the beetles as before. If the trees are numerous, the sheet had better be fixed permanently on a frame, in the form of an inverted umbrella, and carried on a cart, to be pushed by handles, something as a wheelbarrow is moved. Opposite the handles there is a slit in the sheet, so that the center may be brought immediately under the center of the tree top; a small tin box may be attached under an opening at the center, with a sliding cover, which may be opened and closed at pleasure by the man at the handles. After the jar is given, the weevils may be shaken into this box, after which the lid will be at once closed. The mallet may rest across the handles when not in use. That the trees may receive no injury from the blow, a spike should be driven into the same at a convenient height to be easily struck with the mallet. After passing to all the trees, the curculios in the box should be scalded or burned.

The Cherry Orchard.

If cherry orchards receive visitations from the curculio, so that wormy cherries become a source of annoyance, then the trees should be treated in May and June as described above, for the same insect in the peach and plum orchards.

In the last days of June, and again in early September, it is not uncommon to notice that the foliage of the cherry and pear trees turns sear, as if scorched by too close proximity of withering flames. When such an appearance is noticed, quick-lime should be thrown into the trees, so that it will surely touch all branches which are thus affected; if lime is not convenient, road-dust will answer, though it is not so sure or speedy in its effects. We will thus kill the slugs, the cause of the blight observed, and save our trees from great injury and perhaps from death.

The Pear Orchard.

If the slug eats the outer skin of the leaves, causing them to wither and die, practice the same remedy as explained above in treating of the cherry orchard. If the pears are wormy, use the bands and scrape off rough bark as mentioned in directions for care of apple orchard. If the trunks are bored and the twigs wither from the effects of an insect, then use the soap and burn the twigs as explained while speaking of apple orchards.

As a preventive of pear blight, I would advise the soap application in June and July, but would add one-fourth of a pound of concentrated solution of carbolic acid to every three gallons of soap. This may not prove a cure, though I have faith that it will prove a benefit. At least, let the experiment be made the coming season, and the results, whether favorable or unfavorable, reported.

Small Fruits.

If the currant-bushes are threatened with defoliation in June, by a green "worm," dotted with black, dust the leaves with powdered white hellebore. Or they may be sprinkled with a mixture of hellebore and water, using one ounce of the powder to a pailful of water.

Let the currant bushes sprout freely, and the first of June cut out and burn all limber and feeble stems. Be sure to cut these the first week of June, and do not fail to burn them.

When it is contemplated to plant a strawberry bed, the ground should be kept

well harrowed or spaded for some weeks before setting the plants, and if possible the chickens should be given free access to the same. We shall thus be rid of Michigan's worst pest to the strawberry-grower, the white grub.

Here, then, I have given in brief space rules which, if followed, will remove much of our anxiety as to losses from injurious insects. Should you desire to know more of the insects that do the mischief, and how the advice serves for protection, I would refer you to my pamphlet published last year, which also occupies a place in the Report of the State Board of Agriculture for the year 1874.

May we not hope that you who are directly interested will do your duty to yourselves and neighbors by using every proper effort to secure a general application of the means explained above, while WE who are investigating will endeavor to keep you informed as to the latest discoveries, not only of new insect pests which ever and anon will come among us, but also of new and improved methods whereby we may circumvent both new and old. By thus working together we may assuredly triumph over the greatest obstacle and discouragement that at present confronts the farmers and fruit-growers.

Wm. Cumming, Saugatuck.—Is it the same kind of cut-worm which destroys our corn?

Prof. Cook.—There are twelve species of cut-worms which work in this State. Four species climb fruit trees and eat the buds, and eight species cut the corn, cabbages, etc. After the moths pair, which produce these cut-worms, they lay their eggs wherever grass or weeds are found, and the eggs hatch out, and all during the fall the young cut-worms are busy eating the roots of the grass and sometimes the blades, but their depredations this time of year attract but little attention. The next spring they are nearly grown, and then the work of destruction goes on. The climbing cut-worm is kept from destroying the buds of the trees by placing tin bands around the trees. These bands are from 2½ to 4 inches in width.

Mr. Cumming.—In our part we have tried making a ferule of an old oyster can, placing it around the roots of a young tree and packing the earth tight around it. This we found to work effectually, and we think it an improvement on the tin bands, especially on small trees.

Prof. Cook.—I am glad this has been mentioned, for Judge Ramsdell of Traverse City told me that he found this plan an excellent way to fight the peach-borer. The only fault I have to find with this way of dealing with the cut-worm is that the pests might come up in the dirt between the tree and the band.

Mr. Cumming.—There is another fact I would like to state in regard to these borers. Mr. Gerber of Douglas says that when he planted his orchard two years ago, around a portion of the trees he put tan-bark. The trees which had no tan-bark around them were invested with the borers, while those surrounded by the bark escaped injury.

Prof. Cook.—I think very likely the tan-bark may do good, as it has a certain odor, and may serve to keep the borer away. I have never seen it mentioned before.

G. W. Griggsby, Trowbridge.—Will soft soap keep them away?

Prof. Cook.—I cannot say as to that. I know positively that soft soap will destroy bark lice, and should think it might prevent the borers from laying their eggs, as we know it does the apple-tree borers.

A voice.—Whitewash, it is said, will prevent the borer from laying its eggs.

Levi Loomis, Ganges.—No tree can live any length of time plastered over with whitewash.

Mr. Griggsby.—I was troubled very much with the borer, watched them carefully, and could not keep them out until I practiced whitewashing, and since that have been troubled but little. I have seen no ill effects from its use. I am told that in Wayne county, New York, they use lime in its full strength with great success.

A. S. Dyckman, South Haven.—I think I have put lime on my trees nearly a quarter of an inch in thickness, and have never observed any injury.

H. G. Buck, Hopkins.—I have been annoyed by a bug on my grape vines which is represented here as the flat-headed borer.

Prof. Cook.—It is not the flat-headed borer, but the rose-chafer. If your vines were so you could shake them, you could put a sheet under them and capture the beetles. They are miserable pests. Paris green will kill them, but hardly any one wants to try it. It would certainly kill them if sprinkled on the vines when in blossom, and there could hardly be any danger from bad effects. However, Dr. Kedzie would be better authority in regard to the use of Paris green.

Dr. Kedzie.—There would be no danger so far as the flesh of the grape is concerned. The only danger there could possibly be is that of the Paris green remaining upon the grape and being eaten with the grape, and that would be a very improbable thing. In the use of Paris green it should be borne in mind that it is a very rank poison.

Prof. Cook.—In Illinois, during the past two or three years, Paris green has been used with excellent success to stop the ravages of the canker worm.

John. B. Allen, Trowbridge.—I have found strong soap suds, applied to the nests of the tent caterpillar with a rag tied on a stick, an excellent way to kill them.

C. W. Bremen.—When is the best time in the season to catch the apple-borer?

Prof. Cook.—The method to prevent its coming is to put soap suds on the trees about the first of June.

G. H. Bennet, Allegan.—Will this piece of tin put on the peach tree prevent the codling moth from going up the tree?

Prof. Cook.—The codling moth is a winged insect, and can fly like a pigeon. There is no way to prevent its eggs being laid, but if you would all practice putting bands of cloth around the trees, and destroy the larvæ and pupæ as mentioned in the lecture, you would be well paid for your trouble. Keep the rough bark off your trees, and your cellar windows closed by fine wire gauze. The worms in the apples hatch out into moths. On July 8th I counted nine of these moths up against the wire gauze of one cellar window at the college.

Mr. Blackman.—In what manner do you apply Paris green to kill the canker worm?

Prof. Cook.—Put it on with a syringe.

Mr. Cumming.—Did you receive some leaves of the Clinton grape-vine from R. Newman of Saugatuck? He showed us some leaves which were greatly increased in thickness, and seemed to be filled with myriads of little flying insects. No one there could tell what they were.

Prof. Cook.—I never received the leaves, but I think, from your description, I know what they are. It was evidently a species of plant louse. If it had no

wings, I should say without hesitation it was the leaf or gall form of the Grape Phylloxera, or grape-vine pest of France.

Mr. Julius Anderson of Otsego then read the following essay, entitled

BREEDING AND FEEDING SWINE.

Essay by J. A. Anderson of Otsego, read at the Farmer's Institute.

MR. PRESIDENT AND GENTLEMEN: In writing upon the topic which I have chosen, neither my time nor ability will admit of my attempting an elaborate discussion of so important a subject, and mentioning *all* the points that are worthy of notice,—which others more learned and experienced might present and make interesting to you,—therefore I shall only give my own ideas, as best I can, which I have gathered from experience and observation; and if by so doing I can induce any brother farmer to change his course in this matter, and act in future more in keeping with his own best interests and the dignity of our calling, my object will have been fully accomplished.

In my opinion there is no subject of more vital importance to the farmers of Michigan than that of breeding and feeding swine; and at the same time there is none about which the majority of farmers have manifested greater stupidity and carelessness. But some, and I may say many, are beginning to see and appreciate its importance, and are comparing the unsatisfactory results of their own efforts in pork-raising with the paying, and therefore satisfactory experience of their neighbors; and (with the exception of a certain class who always claim that *the way my father and grandfather did is the best way*) they are coming to the conclusion that there is, after all, a difference in breeds not wholly attributable to the swill-pail; and not only a difference in breeds, but a something about the management and feeding of swine that they do not understand, which produces such widely varying results. Therefore a spirit of inquiry into the real causes is manifested, and it betokens good.

That success depends much upon proper breeding, no sensible man will dispute. The successful breeder seeks first for animals of good form and good constitution. He also looks to a clear pedigree. In the selection of a breed, many circumstances, his associations, and his taste control him largely. But for profit, a breed which matures early, and which will yield the largest amount of fine pork at a given age and from a given amount of feed, must take the preference. These points I had in view in making a selection for my own use, and in my judgment the Poland China possesses these qualities to a higher degree than any other known breed. At all events, I have never seen cause to regret my choice. That much has been, and may still be done in the improvement of swine, by crossing the native and mixed breeds with the pure, there is no room for doubt, but this should be done in all cases by the use of the thoroughbred male. A serious objection, however, to mixed breeding, is a tendency to unevenness in breeding. The most satisfactory results may be attained, and with the greatest degree of certainty, by beginning with thoroughbreds, and then keeping strictly within the breed, always avoiding the coupling of near relations. This last suggestion is based upon the principle that every individual has its excellencies and defects, and (as Prof. Jones of Iowa says) "near relations are likely to possess the same excellencies and defects, and by coupling such relations both excellencies and defects are aggravated and intensified." Therefore the defects may be so intensified as to destroy the utility of the product again. Breed together animals of like character. The product will be like the parents:

they will be even and sure. But with all these suggestions in regard to the selection of breeding stock carried out, a failure is inevitable unless proper attention is given to the general comfort and the feeding of the mothers at all times, but more especially during the period of gestation. A large share of farmers are too careless and indifferent to the wants of their domestic animals at this critical period. Want of proper food, of comfortable shelter and places of rest, worried by dogs and more cruel men and boys, it is no wonder that disease, abortions, and weakened vitality of the race ensue. And I venture the assertion, without fear of contradiction, that, generally speaking, the pig is the most neglected and abused animal we have under domestication, and none yield a better percentage of profit when properly handled and cared for. My experience and observation have taught me that sows kept for breeding should neither be starved nor made very fleshy; but should be fed with a view to the most perfect health and vigor. Confining in a close pen is decidedly injurious. They should have sufficient range for exercise, with such a variety of food as their instincts call for. As the time of farrowing approaches more generous feeding is required, as there is an increased demand upon the vitality of the sow which should be met by a full diet. But this, instead of being a stinted allowance of dry corn, thrown out in a snow-bank, on the ice, or in the mud, as the case may be, should be composed mostly of green, succulent, and light diet, carefully avoiding all heating and stimulating food. House and dairy slops, bran, shorts, or coarse provender, with good pasture range in summer; in winter some kinds of both vegetable and animal food is advisable. I would discard dry corn altogether. About the time of farrowing the sow should have a well sheltered place by herself, free from all annoyances, and little or no feed the next day after, as a pail of swill often proves fatal to the sow, especially in hot weather. In the rearing of pigs the sow should have good pasture range, and the trough should be made in such a way that the pigs can eat with the sow, which they will soon learn to do, and thus relieve the mother, and be prepared to go by themselves at eight or ten weeks of age, without materially checking their growth, after which time they should have about the same kind of feed as given the sow, until fairly weaned. After the weaning, in the absence of clover pasture, I have never found any feed better adapted to their growth and development than corn with a liberal mixture of oats, ground together. In the absence of oats, plenty of bran or coarse middlings mixed with corn meal works well; and in the absence of corn and oats they will do finely on mill-feed alone.

The feeding of swine at the time of fattening is a point of vital interest to all engaged in pork-making, and in no part of farm management do the majority of farmers act more regardless of economy and their own best interests, and do their work in so slovenly a manner as in this particular. The complaint may be heard from many farmers the country over, "My hogs are not fattening as I would like to see them, and as they ought to for the feed they have. I give them all the corn they can eat." Still the results are unsatisfactory. Visit their pens, and you will see evidences of an indiscriminate waste of feed and valuable time at a season when the porkers should be making rapid strides toward their last resting-place, the pork-barrel. Yes, waste of feed,—corn (in the ear, of course,) enough on the floor to feed them from one to three days, and more (if dry and hard) than ought to be given them during the whole process of fattening. If your visit is made at or near the hour of feeding, the pigs are too dull to show themselves; not because they have eaten too much, but because their appetites are cloyed, and they have no relish for the dry, hard, uninviting morsels

given them so lavishly. At the same time pour into the trough (if there is one) a liberal allowance of well ground feed, mixed with cold water even (to say nothing of having it warm and inviting), and they will show themselves on a double quick, and eat as though they had just observed a day or two of fasting and abstinence. Who need wonder at unsatisfactory results? They are but the legitimate results of such a course. It is a fact too well established to leave any ground for argument, that ground feed, well mixed with house and dairy slops or water (and if scalded or cooked all the better), will pay liberally, not only in the saving of feed, but in the time required to fit an animal for market, as well as in the satisfaction of seeing your pigs flourishing and contented under your care. But to secure the best possible results from this kind of food, attention should be paid to regularity in feeding in regard to time; and to secure a good appetite, healthy digestion, and a keen relish for food, a little salt should be added to it, either in the swill-barrel or otherwise. A few wood ashes occasionally are also a good appetizer, as well as a preventive of disease.

In regard to quantity of food, never feed more than will be eaten with a relish and the trough licked out. By following these rules closely, and by proper attention to cleanliness, no farmer need fail to secure satisfactory results from his efforts in fattening swine. Why not practice common sense and economy in breeding and fattening pigs as well as elsewhere? Try it, all who have not, and, my word for it, it will pay you as well, and you will feel as well satisfied with this as with any reformatory change in your farm management.

DISCUSSION.

Henry Shultes.—Have you ever kept an account to see whether you realized full cash value for the grain which you have fed to your hogs?

Mr. Anderson.—I have never kept any accurate account any more than I have in wheat-growing. I am much better satisfied with my efforts in raising and fattening swine than in raising and fattening cattle.

Prof. Cook.—You spoke of the Poland China: Do you think them better than the Essex or Berkshire?

Mr. Anderson.—I do, on account of size; and I have never seen any other breed that would mature earlier.

Mr. Sherwood.—How early will they mature?

Mr. Anderson.—I butchered three pigs in December which were dropped last April, and one of them dressed 310, one 309, and the lightest 286.

Mr. Shepard.—Have you ever tried cooking food for swine?

Mr. Anderson.—I have never gone further than scalding it; but there is no doubt of the beneficial results of such a course.

Spencer Marsh.—Did you ever try meal without wetting it?

Mr. Anderson.—I have; but I never could get my pigs to eat it in a satisfactory way.

Mr. Marsh.—My experience has been that I got the best results in fattening hogs by dry feed.

Levi Loomis.—A few years ago the Suffolk breed was recommended by nearly every farmer, and I would like to inquire if that breed has run out, or has it been discarded for the Poland China or some other?

Mr. Sutherland.—I have had experience with the Suffolk hog, and have also raised the Poland China; and I think any one who has raised the two breeds will say we have taken a long step forward by discarding the former for the latter. In the first place, the Suffolk are too light bone to carry the weight

which they will put on. My experience has been that when you get a pen of Suffolk hogs nearly ready for slaughter, some of them will break down; whereas you can load the flesh right on to a Poland China, and he can stand up and carry it around. They are also of a quiet nature, which is a very important feature.

Mr. Anderson.—I suppose there is no doubt whatever of the superiority of the Poland China over the Suffolk. I know of no pure Suffolk in this country, although there may be. Mr. Smith, of Detroit, breeds them quite extensively, and also the Berkshire and Essex. Some of these gentlemen have spoken of the great weight which the Poland China can carry. Mr. Brackett, formerly of Marshall, had a hog which dressed nearly 750 pounds. Just before he killed him some friends were astonished to hear him state what they thought the incredible amount of weight which the Poland China hog could carry. Mr. Brackett is a man who weighs 140 pounds, and he stepped right upon the shoulders of the hog, and it never crippled under him. I have never seen a hog with as good a leg to carry weight, and yet mature as early. I butchered three pigs this fall which came in April, and I marketed them in this village about eight weeks ago, and they brought me nearly $54. I have three more in the pen which I showed at the county fair, and on which I received first premium. They are so fat that I shall be obliged to kill them very soon. They came about the first of May, and some estimate their weight as high as 300 pounds. I don't think they will dress that, but so far as my experience goes they excel anything I have ever seen.

Mr. Ferris.—I bought a male pig of this breed during the fair, and put him with my other pigs, and in about three weeks he got so fat he could hardly walk. I had actually to take him away from the other pigs, and starve him right down. If there are any finer hogs around the country than he is I don't find them.

Mr. Sutherland.—I can tell him where he can find as handsome a one as he can see anywhere. I bought a pig two years ago, and I put him on a diet so I knew just what he was eating, and he became very fat, but he could get around for all of that. I never knew a Poland China to cripple up unless put on a plank floor and kept there. It is a singular thing to me that a Poland China hog should be unable to walk.

Mr. Blackman.—I would like to ask Mr. Anderson what are the best points in a hog for breeding or fattening purposes.

Mr. Anderson.—My idea is that the best points in a hog are early maturity, and the greatest amount of pork from a given amount of feed. I presume Mr. Blackman understands the good points in a hog as well as I do. Good length and breadth, a good shoulder and ham, and a bone of sufficient size to hold up the necessary weight, are points which should not be overlooked.

Mr. Loomis.—I find, in looking over the stock pens in Chicago, that in Illinois and Iowa they invariably raise the small-bone hog. The breeders claim they mature quicker, and require less feed for the same amount of flesh. One man who brought in five car-loads of his own raising claimed that the small China hog, crossed with the Poland, gave a hog which would mature early, and takes but a small amount of feed to bring it up to 250 pounds. This is about the class of hogs you find in the yards at Chicago, and they have been bred for the profit there is in them. If those breeders have the right idea, then there is a wrong here in breeding large-bone hogs. The large hogs which reach that market are most always maimed, for they can't stand jamming in cars, or driving either.

Mr. Anderson.—I would like to state, in regard to the hogs which I am breeding, that Mr. Jones of Richland, Kalamazoo county, of whom I purchased, informed me that he bought in Ohio some of both sexes from two distinct families, called the large-bone and small-bone Poland China. These varieties he crossed, and the hogs I now have are products of that cross. The first Poland China which I bought of Mr. Bracket, and butchered a year ago this fall, was fed no grain during the summer, and had June grass instead of clover. He got no grain at all until I turned him into my wheat stubble, where I kept him until I took him up to fat. I butchered him in December, and he dressed 564 pounds. I might easily have put another hundred pounds on him, if I had fed grain during the summer. I have no doubt at all that I fatted that hog and raised him as cheaply as I have a great many hogs of other varieties which did not dress 300 pounds.

Mr. Henry Shultes, of Martin, next read the following essay, entitled:

RAISING HAY AND FATTENING CATTLE.

The grass crop of this state, as well as the other states of the union, is among the most important of its products, and the question how to raise a sufficient amount of hay to properly feed the stock which ought to be kept on the farm, is one which has sorely perplexed many a farmer. Especially has this been the case during the last three or four years, when excessively dry weather during the growing season has been the rule, and moist weather the exception. On every hand we hear the complaint from farmers: "My grass seed failed to catch on account of the drouth." While it may be, and undoubtedly is true, that extremely dry weather during the latter part of the spring and early summer have contributed in no small degree, it is equally true that the difficulty may be partially traceable to other causes. The desire to produce those crops which may be most easily and speedily converted into money has induced many a Michigan farmer to direct all his energies to the raising of wheat, barley, oats, and corn; and these products have been sold from the farm from year to year, while little or nothing has been returned to the soil to restore the fertility thus taken away. At length, when inferior yields admonish the husbandman that his soil is becoming exhausted by these repeated croppings, and he concludes to seed his lands to grass, to his great surprise his seed does not "catch." Unwilling to charge this result to his own mismanagement, he attributes it to drouth, frost, or anything beside the real cause. Assuming that we find the farmer in this situation, how to make a meadow becomes a serious question. To rescue the soil from its barrenness and restore its fertility, is the point toward which the first effort should be directed. To sow grass seed on land, on which repeated experiments have demonstrated that it will not grow, is sheer folly. In making a meadow, I would recommend, first, summer-fallowing thoroughly, thereby destroying all weeds and rendering available for the growth of grass every particle of fertility remaining in the soil. Next, I would spread upon the surface all the barnyard manure obtainable, together with ashes (which, by the way, are a very good fertilizer), and gypsum or plaster. I would leave the plaster and ashes, and the manure, if well rotted, upon the surface, or slightly worked in with the cultivator. Then, about the first of September, sow six quarts of timothy seed to the acre, and in early spring four quarts of clover seed to the acre. Clover seed should be sown when the ground is honey-combed with frost, and before it is settled. If the ground to be sown is reasonably fertile, wheat may be sown or drilled in at the same time with the timothy seed; but if the field has been exhausted by repeated croppings it would

be better to allow the grass undisputed possession, and the result would hardly fail to be a "good catch." When the ground is well settled, so that a team and wagon can be driven on it without injury, plaster sown on it at the rate of one hundred pounds to the acre, would on most soils prove a profitable investment. Following this mode of treatment, a fair crop of grass might reasonably be expected the first season after seeding, with increasing yields during succeeding years. The foregoing is written for that too numerous class of farmers who, by injudicious management, have impoverished their farms to such an extent that raising grass seems impossible, and between this time and spring they will be seen traveling about the country with wagon and hay-rack in search of the farmer who has hay to sell on *credit!* The good farmer needs no instruction from me. His farm is kept in good condition, and by a judicious application of fertilizers, his crops, both of grass and grain, grow better each succeeding year. There is one practice, however, that prevails among good farmers, and against which I here enter an earnest and emphatic protest. I allude to the custom of pasturing newly seeded grass lands during the autumn after the wheat crop has been taken off; a practice which, in my opinion, ought to be strongly condemned. The roots of the young timothy during the first season have but a slight hold upon the ground, and animals, in pasturing upon it, pull it up to such an extent as to seriously impair the subsequent growth. This is particularly the case in dry weather, and in very wet weather the injury is scarcely less from tramping the young plants into the soft ground. I lay it down as a principle susceptible of general application, that no animals should be allowed to graze upon land the first year after being laid down to grass, and never upon land intended for meadow from the first day of September until the crop of hay is taken off the season following. The cutting and curing of hay, of which I had purposed saying something, having been assigned to an abler pen, I pass by, and proceed to the other division of my subject ("Fattening Cattle"); and here, I frankly confess at the outset, that what I don't know about this subject, would, if told, occupy much more space on paper than the facts with which I am acquainted. Though there has been scarcely a winter during the last twenty years in which I have not fattened several head of cattle, I have not conducted the matter in that systematic manner by which accurate results are obtained. That the business of feeding cattle for market has been a source of profit to me, I have no doubt. That it would prove equally advantageous to any and every one who might engage in it, I seriously question. Like every other occupation, feeding cattle for market requires the exercise of good judgment in the selection of animals to be fed, and experience, in care and feeding, to secure the best results. Even with these requisites, the practical feeder may not always realize a greater net profit for hay and grain fed to animals than he would have received for the same products if sold in the market; but by manufacturing those products into fertilizing material for enriching the farm, he can scarcely fail to be the gainer in the end. But without theorizing further I will briefly give my practice in fattening cattle.

My barn is one of those old-fashioned structures built when Allegan county was considered younger than it is at present, and it was deemed essential for the good of the products to be stored in said barn, that there be cracks or openings of from one-half to three-fourths of an inch in width between the boards used for enclosing it, in order to permit the free circulation of air. Beneath the frame of the barn I have constructed a basement 68 feet long by 36 feet wide and nine feet high, with a stone wall on three sides, in which are stables for feeding cat-

tle. My custom has been to buy cattle (steers generally) from two to three years old, during the summer and fall, or whenever I could strike a bargain that seemed desirable. And right here comes in the necessity of exercising good judgment. There are animals that are dear at almost any price at which they might be purchased, for feeding purposes. Among these may be mentioned old oxen, stags, and animals which have been half starved during the early stages of their growth, and a farmer can scarcely put good hay and grain to a worse use than feeding them to such animals. I never purchased but one pair of old oxen to fatten, and although they were purchased at a low price, as I thought, they were the poorest investment in cattle that I ever made. I lay it down as a rule, with slight variations, that the feeder should buy none but young and thrifty cattle. When pasture gets short in autumn, or grass is frost-bitten, commence fodder or hay, and a little meal should be given to keep the animal in a growing and thrifty condition. After the middle of October in this latitude, cattle may profitably be stabled every night. The man who attempts to fatten cattle, with the cold, frosty ground for a bed and a rail fence for a shelter, will find himself making progress in the wrong direction. When cold weather sets in, I deem it best that the cattle to be fattened should be confined to the stall during most of the day, and I am by no means certain that they are benefited by being allowed to run out at all. However, it is a convenience to turn them out to water, which should always be near at hand, and in sufficient quantities. Running the gauntlet of half a mile or more, harrassed by men and dogs, and at last drinking out of a muddy pond through a hole cut in the ice, is not a strong incentive to growth or laying on of flesh; and yet it is a fact that thousands of cattle in the State of Michigan have only the alternative of total abstinence from drink, or obtaining it in the manner suggested. Dig a well near your barn, and put a windmill over it to pump your water (unless you have a better source of supply), and if you are wintering a dozen head of cattle annually the mill will pay its cost long before you die of old age. As to the amount of feed to be given to each animal, no specific directions can be given. Nature is so capricious in her moods that while of too animals of equal size and appearance one may eat and digest properly twelve quarts of meal per day, the other may fail to eat half that amount. I am feeding, for beef, ten head of cattle, two and three years old. Each animal is fed of oats and corn meal, ground together in the proportion of two bushels of corn to one of oats, three quarts in the morning, then all the timothy hay they will eat until two or three o'clock in the afternoon. They are then turned out to water, the stables cleaned and bedded with straw, mangers cleaned out, and the cattle again put in and fed three quarts of meal each. After this each animal is fed one and a half bushels of chopped corn-stalks, which makes the allowance for twenty-four hours. I would prefer a greater variety of feed, such as carrots, ruta-bagas, or mangel-wurzels, but have heretofore not been successful in my efforts to raise any of these crops. I shall increase the amount of meal fed as the season advances, and do not expect to put my cattle in the market until April, or perhaps later.

I have here outlined, not very briefly, my views on the subject of fattening cattle. I do not profess to have achieved eminent success in the business. On the contrary, I am fully aware that I have yet much to learn as a feeder of cattle. What I have written has been not so much with the expectation of imparting instruction, as with the hope of drawing out and profiting by the experience of others. If in what I have written there shall be found a suggestion that shall prove profitable to any individual, or shall incite others to give

their experience on the subjects herein touched upon, I shall feel that my object has been fully attained.

DISCUSSION.

Mr. Tomlinson.—Do you consider hay a first-rate article for fattening cattle?

Mr. Shultes.—I think good hay is a good thing to feed; but I don't know as a man can get $15 a ton for his hay by putting it into beef.

Mr. Tomlinson.—I asked the question because I lately read an article in the New York Tribune, from Prof. Arnold, in which he considered dry hay, in a measure, indigestible; and he claimed that grass was the true standard to go by.

Mr. Shultes.—Hay is the next thing to green grass for fattening cattle; the time of cutting and curing it is, however, a matter of considerable importance. I cut my hay when it is nicely in blossom, and cure it with as little exposure to the dew as possible. Hay that is fully ripe is of little value.

Mr. Loomis.—Do you ever try sowing your grass seed when you drill in your wheat?

Mr. Shultes.—I sometimes seed at the time the wheat is sown. If I don't sow my grass seed in the fall, I wait in the spring until the ground is sufficiently dry and then I go over it with the harrow. My soil would be called a clay loam. It is underlaid with gravel to the depth of about three feet.

Mr. Blackman.—What kind of grass, do you think, makes the best kind of hay for fattening purposes?

Mr. Shultes.—About 25 per cent of clover,—usually less,—and the other portion timothy.

Mr. Jewett.—How long do you allow meadows to be seeded before breaking up again?

Mr. Shultes.—Not more than two or three years. I think four times is the most I ever mowed a meadow in succession.

Spencer Marsh.—Do you ever cut hay when the seed is fully formed?

Mr. Shultes.—I have, some. That used to be the rule, and it was said that you got both hay and grain; but I failed to find that it was either.

Mr. Loomis.—Grass-growing is getting to be an important question. You go into adjoining counties, where they use plaster liberally, and you will find they cannot grow grass. I would like to know if there is any man here who can give us a reason for this. Isn't this getting to be the case in Allegan county?

Mr. Blackman.—I have sowed plaster for the last twenty years, and generally have good success in getting a good stand of clover. The drouth has killed it sometimes, but I can see no difference in late and former years.

Mr. Loomis.—That is not the case with men in Calhoun county. Some of the best farmers of that county cannot grow grass. Some of these farmers have sold all their hay, grain, and wheat for years, and they now find it impossible to seed their ground. I haven't sold as much hay as I have given away in the last 25 years, and I never have any trouble in dry weather. Now, there is something wrong, and if this thing hasn't got into Allegan county, don't let us allow it to get here.

Mr. Sailor.—I was brought up in Pennsylvania, where the people don't see after four clock, but you can hardly get one of those farmers to sell a pound of hay or a pound of straw. They raise timothy and clover, and believe in a rotation of crops; but you can't get them to sell their hay or straw, and the consequence is I never saw finer farm products than they raise. They believe in the

principle that it is what you put on the land, not what you take off, which makes it rich.

Mr. Bigsby.—I think the trouble is that we take too much from our meadows without putting anything back. In the early part of the season some of our farmers turn their stock into the highways until they secure a crop of hay, and then they turn in their stock and pasture these meadows until nothing is seen. The consequence is that there is nothing to protect the roots of the grass, and it soon dies out. What straw they raise is usually sold for $1 per load, and in this way of managing the soil is entirely exhausted.

Mr. Shepard.—There is no difficulty, as a general thing, in getting a good catch of clover. That is, it will spring up and grow until the dry weather comes on, and then it dies out. There ought to be another crop on the ground to hold the moisture.

Mr. Shultes.—I sow my timothy in the fall and the clover in the spring; then there is something to cover the ground and hold the moisture. A heavy crop of wheat growing and maturing on that ground will kill the clover, unless there are rains very frequently. I sowed my clover once when I sowed my wheat. The young clover came up pretty nice, and when about two inches high there came on a hard frost and killed it. That was my last experiment of sowing clover seed in the fall.

Spencer Marsh.—It strikes me that land that is capable of producing wheat is also capable of giving clover a start. My experience is that clover growing with wheat is less liable to drouth than when growing alone. The gentleman thinks we cannot do without hay. I raise but very little, as my land is not adapted to it, and I depend on corn stalks. My father had a farm, when I was a boy, capable of producing two or three tons of hay to the acre, and he used to think his cornstalks more valuable than his hay crop. A word in relation to the time of cutting hay. A gentleman near Philadelphia made careful experiments in regard to early and late cutting, and he discarded early cutting. That was the experience of my father. He was the last man to cut his grass, and when asked for a reason, would reply, "Ask my cattle and horses. They can tell the whole story better than I can."

Mr. Amsden.—I would like to ask Dr. Kedzie in relation to the relative value of a load of straw and a load of muck.

Dr. Kedzie.—It is according to how you use your straw or how you use your muck. As far as the valuable ash elements are concerned, there is more in a load of wheat straw than in the muck; but as far as nitrogen is concerned, the muck contains the most.

Mr. Amsden.—The reason why I asked the question was this: We had on the old farm a little lot called the meadow; and to my certain knowledge, for fifteen years in succession we mowed as large a swath as a man could put aside. It was the clean timothy. Every spring a small brook flowed it for some five or six weeks, and my theory was that the brook brought down the elements of the muck and distributed them over the field, which caused this remarkable yield of grass year after year.

Dr. Kedzie.—In addition to the vegetable matter brought down, we find that most of the water in the streams of the country is hard, and contains sulphate of lime and alkaline salts in solution. These materials, deposited by the waters over the surface of the meadow, account for the marvellous crops of hay.

Mr. Loomis.—I would like to ask the doctor if farmers should use salt upon their lands?

Dr. Kedzie.—This salt question is an extensive one, and it would require the rest of the afternoon and evening to fully answer that question. One marked influence of salt is in prolonging the period of growth, and preventing the too early ripening of a crop. On sandy lands the crops tend to complete their growth and ripen their leaves too early. On such soils salt counteracts this tendency and may increase the yield of crops thereby. In clay soils there is the opposite tendency to prolong the period of growth, and on such soils the salt might be injurious by increasing this tendency.

Mr. Tomlinson.—I would like to have Dr. Kedzie tell us how we can improve our pine barrens.

Dr. Kedzie—I have never had an opportunity to examine the soil or the pine lands of Allegan county, and I can say nothing on the subject.

S. R. Lewis.—Will the use of salt on sandy soil prevent the ravages of the cut-worm?

Dr. Kedzie.—From experiments tried at the Agricultural College, we found that an amount of salt that would kill cut-worms would also destroy everything growing upon the soil. Of course salt in proper quantities is beneficial to many kinds of crops.

Mr. Loomis.—Who can give us the best theory of manuring our lands, especially those at a great distance from the barns?

Spencer Marsh.—A good farmer in the town of Parma, Jackson county, took me over his fine farm and said he could replenish his land much easier and cheaper by clover than he could by drawing manure from the barn-yard. Another farmer who used to raise from 10 to 15 bushels to the acre, told me he was not content now unless he got from 20 to 25 bushels to the acre. He kept his land up by clovering and plowing the clover under. He also kept a great many sheep.

Dr. Kedzie.—One of the most intelligent farmers in the United States, George Geddes of New York, told me that by the use of plaster and clover, without the addition of a solitary pound of manure, he raised crops for thirty years, and at the end of that time the land was in better condition than when he began.

EVENING SESSION.

The closing session of this Institute commenced with the following lecture by Mr. R. C. Carpenter, C. E., on

ROAD MAKING.

Road making is an ancient art, and histories, as well as the remains of old roads, attest that in ages gone by, better roads were in process of construction than are being made to-day.

The necessity for roads depends upon the amount of social or commercial intercourse between the inhabitants of any given country or countries.

This age, though surpassing all other ages in the amount of its travel, has given little attention to the subject of common roads, probably because the railroads of to-day better meet the transportation demand.

I would not wish to lower in any way your high opinion of railroads: they

are of immense importance, and have done our country an incalculable amount of good; but is it not possible, with our great desire for railroads, to entirely lose sight of the more important interest? Railroads are expensive, and we can afford to place them only on our most important thoroughfares. Common roads alone must be relied on for all ordinary business matters. No man is content until a road passes near his door, though the majority are contented with a very poor road. So far as the quantity of road is concerned, the people are generally very alert, but the consideration of the quality is frequently entirely neglected.

With our railroads we have reached a high degree of perfection; we have reached a point far ahead of even the conception of the possible 50 years ago. In 1825, Wood, in an article on railroads, says: "Nothing can do more harm to the adoption of railroads than the promulgation of such *nonsense* as that we shall see locomotive engines traveling at the rate of 12, 16, 18, and 20 miles per hour." Yet you all know how it is now. Even 20 years ago, Ritchie in an article on railroads, states that an express train on the Great Western Railway (England), drawing 59 tons, has traveled for three hours at the rate of 63 miles per hour." And to-day no place of great importance is without its railroad. Mile upon mile has been crowded into existence, until our country possesses at least 60,000 miles,—enough to double track the whole globe at the equator and give 10,000 miles for other purposes. We have carried railroading to such an extent that instead of keeping our railroads within the pale of civilization, we have pushed them far beyond the borders of the settled country, miles and miles into the unbroken wilds.

A few years ago travellers on the plains used to tell us that the vicinity of a settlement was unmistakably shown by the presence of what was then known as the "signs of civilization," viz., the whisky-bottle and newspaper. It is different now, though it is doubtful if the influence of either the bottle or the newspaper has in any way been lessened, but the railroad has outstripped them both, and stands with iron rails and telegraph lines, a silent sentinel, far beyond the borders of civilization, yet ever pointing to the region of intelligence from whence it came.

So much we can say for our railroads. How much can we say for our common roads?

It is true they outnumber the railroads, and exceed them in length. But they fall so far below them in quality and in excellence that there are but few miles of really good road in this State. This difference between the comparative merits of railroads and common roads is readily explained when we notice the different methods of building and keeping in order.

From first to last the railroad is the development of a systematic plan, the workings of which is shown not only in its location and construction, but also in the constant labor which keeps it in working order. What would you think the condition of a railroad would be which employed no trackmen, but kept the track in order by annually making a "bee," and throwing the whole force of employés to "fixing track" for a few days? Such a road would be in a bad condition,—probably like some of the southern roads who advertise "two trips weekly." That is, they go up one week and try to get back the next.

Such a system would make every railroad in our country a failure at once. It is absurd to even think of applying such a system to railroading; yet it is the only system we have in this State for mending common roads, and they are certainly more essential to the welfare of our people.

The poor condition of our common roads is due almost entirely to the absence of any general system, either of construction, repairing, or working.

You are doubtless not only well acquainted with those portions of our laws that relate to highways, but you know much in regard to their practical workings. Summed up briefly, they are as follows: The general superintendency of the highways and bridges is given in each township to the commissioner of highways, who is elected for one year, by ballot, and whose duties consist in a proper subdivision of his township into districts, and the general direction of the work. He may be fined for any neglect of duty.

At each town meeting an overseer for each road district is chosen, *viva voce*, whose duty is to take immediate charge of the work in his district, and see that each inhabitant discharges his road tax as provided by law. He is also liable for any injury or damage occasioned by his neglect of duty.

This looks very well on paper, but you all know how it works in practice. The tax-payers are summoned to work on the road, not at the season of the year when their work will do the most good, but to suit their own convenience, be that time early in the spring, in midsummer, or in autumn. The men frequently act as though they had no taste for the work, and seem determined to do as little as the overseer will accept; and as he is from their own number, and apt to be among them in another year, he is satisfied with a very small amount. The day's work done on the road would not generally be accepted by the very man who does it, (if he had to pay for it) for more than one-half or one-third of a day's work; and it is little wonder that our roads are no better to-day than they were twenty years ago.

It is the general custom to change the overseers each year. The effect of this is to keep the road district trying new plans and commencing improvements, but finishing nothing, and frequently, instead of improving roads they are positively injuring them. For instance, one overseer determines to put all the work of his district in filling up a hole now covered with logs. He removes the logs, but the work is insufficient to finish the job, and it has to lay over another year. His successor, thinking something else needs more attention,—perhaps he is an advocate of turnpiking; at least he throws the whole force to work at something else in some other portion of the district, so that among the different plans, and between the different overseers, no one plan is carried into execution, but the beginnings of many are worked out on the road, often entirely ruining and rendering nearly impassable a formerly good thoroughfare.

Again, our overseers are seldom if ever competent to superintend road-making. The making of roads is a life study; and if we expect or wish competent road superintendents we must prepare to pay them; and if we wish good, fair days' work done, we must abolish this old feudal system of working out the road tax, and have our work done by contract and pay for it in money. "There is no excellence without labor," is an old maxim, but as applicable to road-making as to any other pursuit of life.

It is useless to discuss the best methods of making broken stone roads or gravel roads or Telford roads, until we feel we have within us a power that can be made to work up and develop any systematic plan of true road improvement that may be adopted. That power will only arise when legislative action shall have abolished our present system.

Characteristics of a Good Road.

The only essential thing, so far as the traffic is concerned, is the surface. Of course the foundation has much to do with the durability of a road, and even

affects the surface, and would have to be considered in all cases involving a discussion of the methods of construction or of repairing; but since it is entirely concealed, we judge roads entirely by the surface they present. The surface should be sufficiently hard as not to be cut into ruts by passing vehicles. It should be even, and so flat that vehicles, in all positions on its surface, will stand upright, and it should have no grades so steep as to require extra motive power, in ascending, or the use of the brake in descending.

Of course such roads will be expensive. You can not expect any great improvements without some cost, but I think you will find good roads very cheap,—that is if you value your time as worth anything; though it is a lamentable fact that "time and money" are disconnected ideas with the farmer very frequently. The cost of making good roads is not largely in excess of what we pay each year, in time, for the privilege of dragging our wagons through the mud, or of biting our tongues and otherwise mutilating our bodies in riding over bare corduroy roads, or of climbing up a hill for the express purpose of clambering down again.

The cost of a good road will depend on the character of the country through which it is to pass, as hills, marshes, and rivers add much to its cost. It will also depend on the kind and amount of traffic; for if the traffic is heavy the road covering will need to be thick, and *vice versa*. It will also depend on the cost of the road covering. All of these considerations will have to be decided independently for each road. The cost per mile will vary from $100 to $1,000 for the ordinary roads of Michigan.

Cost of Poor Roads.

The determination of the actual cost of our poor roads would be a problem of no great complexity were we in possession of statistics of amount of travel, rate of traveling, amount of road tax, etc.; but no such statistics are taken, neither can they be taken, with our present road system. We have assumed a case which will not differ materially from our ordinary roads. Suppose, as is frequently the case, that 20 teams pass each day over a portion of road 20 miles in length which is in such a *good* condition as to reduce the load to only two-thirds of what could have been taken over in the same time on the same length of good road; there is a waste each day by each man and team of one-third of a day's work, and for the 20 teams and men for a whole year of 300 days, this amounts to 2,000 days work of man, team, and wagon, or a year's work for nearly seven men, teams, and wagons. This work, if paid for at the usual price of $3 per day, would amount to $6,000. In addition to this, we shall have an additional bill for extra wear of horses and wagons, probably increasing the expense one-third, making the total cost $8,000, or a cost of $400 per mile. If the road decreases the load one-half, and you know there are miles of roads where you must either double your time or halve your load, the cost per mile will be one-sixth greater, or $466 66.

Cost of Maintaining Good Roads.

The town of Waltham, Mass., has good roads, and they are maintained under the contract system. Previous to 1865 her roads cost an average annual expenditure of $66 per mile. In 1868 an extra fall of snow raised the cost to $117 per mile, but in no case does it come anywhere near what we pay for our poor roads. Time does not permit any extended discussion of the economy of good roads, but it is nevertheless a subject worthy your careful consideration.

Grades.

We will call your attention for a few minutes to the subject of grades. Custom allows us no opportunity to use discretion in the location of roads; we are required to follow the section or quarter section line, whether it goes over hills or across valleys, whether through swamps or over rivers.

We can not deny but what this custom leaves our farms in better shape, as the lands were originally parceled out and are now generally owned in the form of sections, or halves, quarters, or eighths of sections, but it seems to me in many cases that we follow this custom so closely as to entirely lose sight of the more important interest.

I know of one instance in which it is twice as far over a steep hill as it is around its base. Now, if a hill rise only one foot in going 20, the draft of the load will be doubled; but a rise of 1 in 20 does not make a steep hill, and a rise of 1 in 30 is admissible on a first-class road, so that in such a case the distance and also the draft would be doubled. In order to convey the same load without increasing the number of horses, the time of going over the hill would be four times the length of the time required in going around the base on an equally smooth road. But it is generally further around the base than over the hill, though not so much as it seems, for "the bale of a kettle is no longer when laying down than when standing up," no matter how it appears. But it will generally pay to go around hills, even though the distance be considerably greater than over them, for it will be seen that grades increase the draft very fast, and consequently require either a corresponding increase in the power or in the time to pass over them. Now, as soon as the waste of time in passing over a road will pay any sort of interest on the compensation a man should receive for the privilege of running a road through his farm, then without any delay should the road be turned to its natural course around the hill, and the waste of power of ascending saved.

Roads should be perfectly level, but since that is in many cases not only impractical but impossible, the question at once is raised, How steep a grade is admissible?

It is claimed by many good authorities, and denied by many equally as good, that undulating roads are less tiresome to horses.

The following table, taken from Gillespie's Roads and Railroads, shows very clearly the detrimental influence of grades, calling a full load on a level, 100 per cent:

On a	rise of	1	in	100	a horse	can draw	90	per cent.
"	"	1	"	50	"	"	81	"
"	"	1	"	44	"	"	75	"
"	"	1	"	40	"	"	72	"
"	"	1	"	30	"	"	64	"
"	"	1	"	26	"	"	54	"
"	"	1	"	24	"	"	50	"
"	"	1	"	20	"	"	40	"
"	"	1	"	10	"	"	25	"

The truths of the statements in this table are shown very clearly by the following experiment: Loading this miniature wagon and then allowing a descending weight to pull it over this board, which can be set so as to represent all the inclinations referred to by the table, you see when the board is level a very small weight moves the wagon, but if the inclination of the board is

increased to 1 in 24 the same weight will only draw one-half the former load, and if we increase the inclination still more, say to 1 in 10, the weight, as you see, will draw only one-quarter of the first load.

In round numbers, on a slope of 1 in 44, or 120 feet to the mile, a horse can draw only three-fourths as much as he can on a level; on a slope of 1 in 24, or 220 feet to the mile, he can draw only half as much; and on a slope of 1 in 10, or 528 feet to the mile, only one-quarter as much. This ratio will vary somewhat with the natural condition of the road bed. As the effect of a nick in a razor that is already in a bad condition is scarcely noticed, so on a road that is already very bad a slight increase in the draught is not so perceptible as on a good road, nor is it so large a proportion of the former draught.

The loss of power on inclinations is even greater than these considerations show, from the fact that the anatomical construction of a horse does not permit him to apply his powers with the same advantage as on a level. A horse on a level is as strong as five men; yet on a steep side hill he is less strong than three,—for three men, carrying each 100 pounds, will ascend faster than a horse carrying 300 pounds.*

Inclinations being always thus injurious, are particularly so where a single steep slope occurs on a long line of road that is comparatively level. It is in such a case very important to avoid or lessen this slope, since the load carried over the whole road can not be in excess of what can be conveyed up this slope. Thus, if a long slope of 1 in 24 occurs on a level road, a horse can take over it only one-half of his full load, and consequently his load over the entire stretch of level road must be reduced accordingly. This evil is sometimes partially remedied by adding extra horses at the foot of the slope, or more commonly by severely exerting the horses for a few minutes, then allowing them an opportunity to rest by blocking or otherwise holding the wheel. Both these methods are poor economy, and occasion a great waste of time to every vehicle that passes over them; and in nine cases out of ten, were this waste of time for a single year actually employed in improving the road, the expense of passing over the slope might be entirely obviated, or at least greatly lessened.

Expense of Grades.

You saw by the experiment that a slope of 1 in 24 was not very steep, and yet that the motive power was double that required on a level. If such is the case, our load must be decreased one-half, and consequently two trips will be required to carry what could have been conveyed in one, had there been an absence of grades. Should we assume as before a certain number of teams passing each day over a certain length of road, and on account of grades only carrying half loads, the cost per mile will be the same as before, viz., $400, provided we assume the same amount of travel. Since a poor road surface, though level, costs us in time $400 per mile each year, while if hilly it costs an additional $400, making in all $800 for each mile of road, we can well afford to spend some little time in devising methods for permanent road improvement.

Different Kinds of Roads.

There are various methods of forming a surface for roads; but of these methods there are probably only three that merit any particular attention from the American public. The three kinds of road that I wish to call your attention to, as peculiarly adapted to our country, are the plank road, gravel road,

* Gillespie, Roads and Railroads.

and the broken stone or macadamized road; the stone pavement in its various modifications is far too costly for any extensive use as yet. The following table of resistances, taken in part from Gillespie's Roads and Railroads, shows very clearly the comparative value of different materials as road covering for level roads. The table also shows the amount a single horse should draw, deduced as follows: From repeated experiments it has been found that an ordinary horse can exert for 10 hours in a day a steady pull of about 120 pounds; consequently, if the proportional resistance of the draught to the load is known, the load can be found by multiplying the reciprocal of the resistance by 120:

KIND OF SURFACE.	Proportion of resistance to load.	Force in pounds required to draw 1 ton.	Load one horse sho'd draw, tons.
Stone pavement	1-68	30	4
Broken stone on stone pavement	1-49	40	3
Broken stone on flints	1-34	58	2 1-29
Broken stone on soil	1-30	66	1 9-11
Gravel road	1-15	134	8-9
Soft sand and gravelly road (ordinary dirt)	1-7	296	2-5

By referring to the last column it is seen that the power of a horse is 10 times as effective on a stone pavement as on an ordinary dirt road; and on a gravel road 2 2-9 times as effective as on our ordinary roads.

The most important consideration with all these roads is the preparation of a thoroughly drained road-bed. No amount of work or expenditure of money in another direction can compensate any deficiency in this. No matter how costly be your road covering, if it is constantly saturated with water your road will be a failure.

Draining may be accomplished by a sufficient number of open ditches, or in a more thorough and permanent manner by covered sewers at the side of the road, fed by diagonal under-drains running under the road-bed proper.

Plank Roads.

Plank roads are suited only for a heavily timbered country; at the best they are but temporary affairs, and are the worst roads possible if not kept in the *best* of repair. As our country grows older they must of necessity be replaced by roads of more permanent character.

Gravel Roads.

There is, perhaps, no road covering so well adapted to the wants of the community in general as our coarse, sharp gravel. Nearly every neighborhood has a bank of excellent road gravel, and the cost of their road covering need be little more than the expense of hauling, thereby forming an excellent road at small expense.

Broken Stone Road.

The best road we can command is the broken stone or macadamized road. The method of making in its earlier stages is very similar to that of the gravel road, viz.: by preparing a well drained and neatly graded road bed slightly convex at the center; to this apply the road metal (which, in this case, consists of angular fragments of stone, not over 1½ inches on any side), in layers of a

few inches in thickness, allowing each layer to harden under the traffic before the next is applied. The thickness of the broken stone should vary with the amount of traffic from 8 to 16 inches. Once made, the broken stone road is the cheapest of all roads. It is a road over which a single horse can easily draw nearly two tons against eight-ninths of one ton on a gravel road.

Travellers in England have often wondered at the huge load the English horse draws, and have frequently thought that it was due to his superiority to our horse; but that is not the case, for when put on our roads he is no better than our horses. The true solution is found in the fact that the Englishmen have invested in permanent roads what the Americans have put in perishable horses. Consequently we find the Englishman doing the same amount of work that we do, with one-third the number of horses; and he says he has made a paying investment, though he has expended an immense amount in his roads.

Every fact indicates that good roads pay in money and in comfort, and the time has now arrived when the consideration should be given them that their importance demands.

Next in order was Hon. Richard Ferris of Cheshire, who read the following essay on

CUTTING AND CURING HAY.

Having never made chemistry a study, I am somewhat timid in entering upon the subject of the proper time to cut and the best mode to cure hay; and I frankly confess that I could not have been induced to enter upon a discusion of the subject were it not that doctors supposed to be sound in faith and practice so materially differ in their views regarding this matter. A writer in the agricultural department of the patent-office report for 1858 (p. 308) says: "In the timothy grass, for instance, the culms are found to contain more nutritive matter when the seed is ripe than those of any other species of grass that has been submitted to experiment. The value of the culms simply exceeds that of the grass when in flower, in the proportion of 14 to 5. Notwithstanding this, it has been contended that, although there is more nutriment contained in the seed crop of this grass than in the flowering crop, the loss of the after-math, or second crop, which would have been produced during the time the seed was ripening, would more than outweigh the superior quality of nutritive matter contained in the seed crop. But for reasons given * * * the cutting of timothy before the process of desiccation has commenced on its stalks, would prove fatal to a future crop from the same roots." Acting, as I supposed, on the best of authority, considering the high source through which it came, the next year I let my timothy stand "till the process of desiccation had commenced on its stalks;" but I never repeated the experiment. My hay was not worth half price. The cattle didn't like it, and a large percentage of it passed under them as bedding. The fact is simply this: the succulent and nutritive properties of the grass had nearly all gone to mature the seeds, and to that extent were lost as food, as stock never digest the seed.

With regard to the other theory of this learned doctor, that "the cutting of timothy before the process of dessication has commenced on its stalks would prove fatal to a future crop from the same roots," I will only say that, for the last nineteen years, I have cut, on my farm on which I now live, more or less hay every year; and with the exception of the year above mentioned I have cut my timothy while in the blow, never allowing it to mature sufficiently for any portion of the seed to shell when the hay was cured. I never cut to exceed three

crops of hay from the same piece of land before plowing the sod under. As a rule I plow the meadow land as soon as the June-grass begins to injure the timothy.

I will in this connection make another extract from the report of the department of agriculture for the year 1867 (p. 299), as it so clearly coincides with and explains my own experience and observations: From what has just been said a practical suggestion may be drawn in respect to the time most proper for cutting plants intended for the support of animals, or for medicinal purposes. It is a fact that a plant is in its fullest vigor, and contains the largest quantity of nutritious juices which are laid up in store for the growth of the young seeds, when the flower is in its greatest perfection, and the pollen is fully matured and commences its fertilization. This condition may be known by observing, in the larger flowers, the pollen scattered on the stigmas; or in the smaller ones, as grasses, by striking the spike or head, when the pollen will appear like yellow dust on the hand. This is the time the plant should be cut and stored away for future use. If delayed beyond this, the nutritious elements are abstracted to perfect the seeds, and the plant gradually becomes a withered, dry, and tasteless stalk. All the grasses, whether upland or lowland, should be cut at this time, as the increase of the seeds will bear no comparison in value with the loss of the nutritious properties of the stalk and flower. It seems almost cruel to deprive the domestic animals of the sweet and nutritious new mown hay by failing to cut it in season."

Redtop is the most productive tame hay that is grown on lowlands, and as fodder for cattle, probably is unsurpassed; but as the time for cutting, and the process of cutting it, are nearly similar to the process of cutting and curing timothy, I shall let it pass without further remarks.

Probably clover needs to be harvested with greater care than any other kind of hay. Like all other kinds of hay, it should be cut when in full bloom. If allowed to stand till the heads turn a brownish color, it becomes almost worthless. The greatest care must be taken in curing it. If allowed to remain too long in the hot sun before it is stirred up, the leaves will curl up and drop off. As soon as it becomes partly wilted it should be thoroughly stirred up, and kept almost continually in motion till it is cocked up. The cock should be made large and very compact. That is the best place to cure clover hay, and it should be allowed to remain in the cock three or four days, till it passes through the process of sweating. When properly cured it makes very valuable fodder. I regard red clover as one of the most valuable crops raised on the farm. Its worth does not consist in its value as fodder; its large, long roots penetrate nearly every part of the ground to a considerable depth, making the soil on heavy land loose and porous, depositing at the same time one of the most valuable of manures. I have heard the plan of covering the cocks of clover with pieces of heavy factory one and one-fourth yards square, to shelter them from the dews and rains, highly recommended. It seems as though it might be worthy of a trial. The amount of hay cut in the United States and territories in 1870 was 27,316,048 tons. During the present year this crop will quite likely approximate 34,145,060 tons, which, if estimated at six dollars per ton, will amount to the enormous sum of $204,870,360. Allowing that fifteen per cent of its nutritive value is lost by allowing it to stand too long before it is cut, or by negligence in curing it, or in both, then the loss in this crop alone aggregates $30,730,554. Would it not appear from this showing that the time has arrived

when the attention of the farming community should be more particularly called to this very important and interesting branch of agriculture?

To resume, hay should never be cut when it is wet. Keep it nearly continuously in motion from the time it is cut till it is snugly put into the cocks; allow it to sweat well before it is drawn to and mowed away in the barn. By this process you will preserve in the greatest perfection all those nutritious elements which make it so valuable as food for animals.

DISCUSSION.

Mr. Loomis.—Is it desirable to cut two crops of hay from the same piece of ground in one year?

Mr. Ferris.—I suppose you might cut two crops of clover but not of timothy. I never cut two crops in one year from the same piece of ground, but usually pasture it.

Mr. Shepard.—Do you practice cocking your hay the first day?

Mr. Ferris.—Always, for I think hay properly taken care of worth twice as much as that which is exposed to the dew and weather. It is better to put it in cocks the day it is cut, if you have to stir it up on the following day.

Mr. Loomis.—What proportion of timothy would you advise?

Mr. Ferris.—About two-thirds timothy and one-third clover. I have good grass land. I think the same proportion would do well on a light sandy loam. Perhaps about one-half timothy and one-half clover would be a better proportion for a sandy soil. If you should sow all clover I don't think you would get any more clover than if you mixed it half timothy. There are certain properties in the soil adapted to one kind of plants, and certain qualities adapted to other kinds. By sowing clover and timothy together I think the yield is materially increased. I consider clover worthless after the heads have turned and the juice has left the stalk.

Mr. Loomis.—Do you practice putting hay in the barn before it is perfectly cured?

Mr. Ferris.—One season I put it in rather damp and had to remove it from one mow to another, and then I took it out and stacked it.

S. R. Lewis.—Did you ever cut your timothy after the seed was ripe?

Mr. Ferris.—Some years ago I got a patent office report, and that advised the cutting of timothy after it had become ripe. I took the advice, supposing the writer knew more about it than I did, and I found it was not as good as bright wheat straw.

The closing essay of this Institute was read by Hon. A. S. Dyckman of South Haven, on

THINNING FRUIT.

It is a pleasure to trace the divine prescience and wisdom in all that affects our welfare here as well as hereafter. These may be seen, in a remarkable instance, in the provision for reproduction of vegetable forms. All possible accidents by fire, flood, storm, and all consumption and waste enter into account, and all consequent needs are met in the constitution of things. So do we often observe a superabundance which may be regarded, casually, as an evil; but in which a deeper insight reveals the beneficent hand of the Great Father. To particularize still further we find, which is our present purpose, that our valuable fruit-bearing trees are prone to set a multiplicity of fruit buds—enough to

run the gauntlet of frosts, blights, mildews, hailstorms, cold snaps, and an innumerable array of insect-destroyers that beset them on every side, and have enough still remaining for an over-crop. So are these rich bounties of nature assured to us most perfectly. All this is so wisely arranged that it does not preclude the necessity of co-operation on our part; that it does not make us mere idle participants in these bounties. "The primal curse softened to a blessing" has its application here in the essential labor of thinning the fruit. A judicious pruning of trees has the effect to thin the fruit very considerably. For various theories on the pruning question reference may be had to the Michigan Pomological Report for 1874. But after all there remains usually a large excess of fruit that must be removed by other means. The first inquiry would be, is it necessary or profitable to thin fruit? Mr. George Parmelee, ex-president of the State Pomological Society, when he lived on his fruit place near St. Joseph, once told me that he and one of his careless neighbors sent to the Chicago market each a lot of the same variety of peaches grown from the same stock of trees, with mainly the difference that his (Parmelee's) had been thoroughly thinned; that his peaches brought twenty shillings per basket, and his neighbors, on the same day, in the same market, brought ten shillings per basket. This instance is given to illustrate the general experience of those who practice thinning. Now, suppose it costs five cents per basket to thin, which would be an outside figure, the increased size and better quality of the fruit would alone be sufficient compensation, to say nothing of the effect upon the health and longevity of the trees, thus released of their over-burden; or of the greater certainty of a full annual crop thereby secured. A percentage of this will perhaps be saved in the reduced cost of picking and marketing, where half the number will give the some bulk; provided too much time be not lost, so to speak, in admiration of the luscious specimens of fruit that, under this treatment, will crown the labors of the year. The time and manner of thinning are important. The time for thinning peaches is immediately after the season of curculio catching by the Ransom process, while the peaches are yet small, so as to have advantage of as much of the season of growth as possible; for the lake shore in this latitude usually from the tenth to the twentieth of June. I have had little experience with other fruits, but may safely say, in reference to apples, thinning should be done while the codling moth-worm is still in the young fruit; when, by selecting the wormy ones, and destroying them with their inhabitants, we would accomplish a not less desirable end in the death of this most annoying and unmitigated pest. Most apples will be improved by thinning, especially where they grow in clusters. Pears may be thinned early and quite expeditiously by leaving but one on each spur, which, where proper pruning has been observed, will leave them thin enough. But we must recur to the peach, which has been a special study with us, and we do not feel quite authorized to speak of other fruits. In determining the time of thinning, present judgment must be used in view of all the circumstances—as the quantity of work to be done, help available to do it, and the advancement of the season. Having made all necessary observations and having the time appointed, at this point comes up the question: in what manner shall the work be done? Since the first fruit was unlawfully abstracted from the forbidden tree, the first natural impulse of our humanity is to shie a club into the tree, and so bring down the object of our desires. The not less heathenish practice of shaking the tree, is about as likely as not to bring down those peaches we desire most to leave. As in harvesting, so in thinning, careful hand-picking, with an

ever watchful eye to the proper distribution of fruit through the top of the tree, is at least the only efficient method known to us. As we proceed to work with our ladders and stools we discover at once the great convenience of low-headed trees; and the break-neck folly of climbing twenty or thirty feet above the earth for fruit that can be more cheaply raised within reach by a seven-foot ladder. It tries the nerve when one is required to pick from a well-loaded tree where the peaches almost touch each other, until they are separated by spaces of about six inches, to be varied slightly as judgment under the circumstances may dictate. I once asked a St. Joseph fruit-grower how to thin fruit. He replied: "Take a club and knock off all you can see—then pick off three-fourths of what remain,"—meaning in metaphor that the thinning should be very thorough. I have given heed to this admonition ever since. Some varieties, like the Early Crawford, bear their fruit in clusters, and often require thinning even when there is not a sufficient number set for a full crop. Each individual peach must have full free space for development. Then, if the conditions of climate, soil, and culture are favorable, we shall have a production to delight all eyes—something we would not be ashamed to send to our centennial world's exposition—a fair testimonial of the charms and graces being wrought by the hand of intelligent labor joined to the infinite skill of a Higher Artist, within the lake-bound borders of Michigan.

DISCUSSION.

Dr. Kedzie.—Suppose you have two trees just of a size and equally loaded with fruit, and you thin one and do not the other, which will bear the greatest weight of fruit? Of course the question of quality is not raised.

Mr. Dyckman.—I should think it would depend very much upon the season. If the weather is extremely dry I should think the properly thinned tree would outbear the other; but if everything was favorable to growth, the tree not thinned would probably produce the most.

Dr. Kedzie.—What would be the effect upon the tree not thinned?

Mr. Dyckman.—It takes a peach-tree a long time to get over the effects of having been overburdened.

Dr. Kedzie.—Here is a point I want to bring out. A large proportion of the peach is made up of pit, and the formation of the seed of anything is a very exhausting process. The large number of pits on a tree not thinned must be exceedingly exhausting. There is another strong argument in favor of thinning, and that is the value of a peach crop is not in the pit but it is in the amount of flesh.

Prof. Cook.—I noticed in the New York Tribune not long since that by a judicious process of thinning, trees which had only borne biennially could be made to bear annually.

Mr. Dyckman.—My experience is that peach-trees bear annually when the season is favorable, but there are certain varieties of apple-trees which only bear biennially.

Mr. Loomis.—Have you ever practiced cutting back young trees?

Mr. Dyckman.—Do you mean the present year's growth? No, sir; I prune entirely by thinning. I never shorten a young or an old tree, but I thin by cutting off the lateral branches.

Mr. Loomis.—What is the best time for pruning apple-trees?

Mr. Dyckman.—There are a great many opinions about it, but I am inclined to think that they should be pruned very early in the season, before they start to grow in the spring.

Mr. Blackmore.—What distance from the ground would you start the head of a peach-tree?

Mr. Dyckman.—Not over three feet.

Mr. Cumming.—When is the best time of year to prune a peach-tree?

Mr. Dyckman.—February or March is a good time to prune, after the stormy weather is over.

Mr. Warren.—In an apple or peach orchard is it advisable to let any other crop grow upon the ground?

Mr. Dyckman.—When the trees are young there is no objection to growing crops of corn and potatoes, but when the orchard is in bearing I should put nothing else upon the ground. Corn is a very good crop for young trees. If you leave the stalks standing they keep the snow from drifting away.

Mr. Cummings.—I think potatoes are objectionable, because they take up so much potash. I have heard that a crop of potatoes takes up three times the potash that a crop of corn does.

Dr. Kedzie.—If you have a good crop of potatoes it will take more than three times the potash from the soil that a corn crop would. Peach trees require a large amount of potash; but after all, the injury from a potato crop would depend very much on the nature of the soil. Trees on a clay soil abounding in alkaline silicates would receive less injury than upon a light sandy soil.

Mr. Loomis.—Is it not true that we lose whole orchards of peach trees by the cultivation of corn?

Mr. Dyckman.—I never knew of such a case.

Mr. Loomis.—Most people cultivate corn after the first of July, and experience teaches me that no peach tree should be cultivated after that time. I can cite you to an orchard of nearly nine acres where the whole crop of peach trees was killed by the cultivation of corn. Another orchard near this one was saved by not cultivating it.

Mr. Dyckman.—How were these two orchards situated?

Mr. Loomis.—On high ground.

Mr. Dyckman.—Did both have the same kind of exposure?

Mr. Loomis.—One was a mile or two nearer the lake than the other. The orchard which was entirely killed was on a clay, or rather gravelly loam, the other was on a sandy, loamy soil. I could not say which orchard was the highest, as they were some distance apart.

Mr. Dyckman.—I think there are a great many circumstances to account for the killing of this orchard beside the cultivation.

Mr. Loomis.—Mr. Dyckman and I do not agree in this matter of cultivation any more than we do in the matter of pruning. I believe that the cutting back of a peach-tree for the first two or three years is essential to its development. The limbs which are cut back are made stronger and stockier, and they are less liable to break down. This plan of cutting back is practiced by the famous Jersey peach-raisers.

Mr. Dyckman.—This whole question of pruning can be found in the Pomological Report of 1874. Mr. Loomis has spoken of the Jersey peaches, and that the peach-raisers of that section practice the cutting back system. The people of Chicago, who are pretty good judges, say they do not raise as good peaches as we do in Michigan, and I think one reason is because they practice a different system of pruning their trees. We usually have a severe drouth about July 1, and I think if you stop cultivation at that time your trees will suffer greatly from the dry weather. Not only that, if you fail to cultivate after July

1, your trees cease to grow about that time, and then along later in the season when the wet weather comes on, they begin a second growth which is very liable to winter kill. But if you keep the trees growing right along the wood matures and will go through the winter all right.

Mr. Sailor.—I have been in Mr. Dyckman's orchard, and he has the best one I have ever seen, and he has made it so by his system of cultivation.

Mr. Crawford.—My experience is the same as that of Mr. Sailor. I have been in many of the peach orchards on the lake shore, and I find the best ones are cultivated up to the time they commence to pick the peaches for market.

N. W. Lewis.—I have seen late cultivation ruin large trees by continuing the growth so late that the wood did not harden sufficiently to stand the severe weather of two years ago. One of the largest fruit-growers in Douglas had about 3,000 trees ruined in two not very severe seasons by late cultivation. My experience has been this: Two years ago I had a young orchard which I cultivated up to July 1st, and then sowed it to buckwheat, which I allowed to remain on the ground. An orchard of five-year-old trees which I cultivated later in the season received much greater injury from the cold weather than did the young orchard. I think Mr. Loomis' theory is partially correct in regard to the heading-in process. It seems to me that five pounds of fruit on the end of a limb would be a greater burden than ten pounds of fruit nearer the body of the tree. By sowing buckwheat as I have practiced for the past two years the ground is protected and the straw becomes manure for the next season's growth.

Mr. Dyckman.—How much lower was the orchard which was killed than the other one?

Mr. Lewis.—Probably ten feet. On the most exposed ground the soil blew off and the trees were killed at the roots. Some of these trees blossomed last spring, and I thought they had come through all right and would have a considerable many peaches, but after a while they withered and died. They were on a dry, sandy soil. Where the roots of the trees were 25 feet lower the tops were badly injured, but I cut them back and they are now in nice condition.

Mr. Crawford.—In the eastern part of the State, just on the border of Macomb county, near the Oakland county line, is a rise of land that stands up prominently, above all the country around. It is more exposed to the blasts of winter than any land in that portion of the State, and yet on that very tract of ground stands a peach orchard which has been there for the past 25 or 30 years, has borne very regularly, and this last summer there was a fair crop of peaches.

Mr. Dyckman.—Where all circumstances are equal the high ground is most favorable; but trees are often killed on high ground where those on lower ground escape.

Mr. Cumming.—There is something in what Mr. Dyckman says about trees dying out on the high elevations under certain circumstances. I have observed in my own and neighbors' orchards, that the trees on the highest and dryest portions of the orchard were killed. The way I account for this is that the dry ground is more severely affected by the frost than where the ground is moist.

S. R. Lewis.—My idea is that the elevations are always the safest. In my own experience, I have noticed that where trees were killed on the ridges it was mostly because their roots were exposed. On this light, sandy soil the wind blows the soil away from the roots, leaving them exposed. In regard to the shortening-in process: When I first came here it had many advocates, but of late there are not many to be found in our vicinity. I am inclined to think that when the trees are young they can be shortened in a little with benefit.

Mr. Anderson.—I would like to inquire in regard to mulching peach trees, and also what varieties will stand winter best.

Mr. Dyckman.—I think mulching young trees is one of the very best things that can be done. It does not seem necessary for older trees. The Standard Late and Hale's Early are among the hardy ones.

Mr. Phillips.—At what time do you put this mulching about your trees?

Mr. Dyckman.—Soon after planting.

Mr. Blackman.—At what age do you plant trees?

Mr. Dyckman.—One year from the bud. Older than that I would not like to plant.

Mr. Blackman.—Do you think Hale's Early a hardier peach than the Crawford?

Mr. Dyckman.—I did not think so until last winter.

At the close of the discussion the following resolutions were introduced and unanimously adopted:

WHEREAS, It is our opinion that the exercises of this institute have been conducive to the advancement of the interests of agriculture and horticulture among us, therefore be it

***Resolved*, That we unite in requesting the Allegan county agricultural society to hold, at least once in each year, an institute similar to this, and we hereby pledge our support to such an enterprise;**

***Resolved*, That we tender our hearty thanks to Professors Fairchild, Kedzie, and Cook, and Mr. R. C. Carpenter, of the State Agricultural College, Mr. A. S. Dyckman of the State Board of Agriculture, and those others who have furnished us with essays, for the valuable assistance they have rendered in the successful conduct of this meeting.**

The meeting closed with a few remarks by Gen. B. D. Pritchard, who pronounced a kind of valedictory over the pleasantest and most profitable meeting ever held by Allegan county farmers. Its entire success was as pleasing to the faculty of the college as to our own people, and they repeatedly expressed their entire satisfaction, declaring that they had been benefited by information gained from the farmers who read essays or debated the points raised. On the other hand the farmers are thankful for the new light they received, and were agreeably surprised to find the agricultural college professors not a set of "starched up" book-worms, but quite unpretending and very practical men, their hands without kid gloves, and their minds well stored with the knowledge necessary for their position. Much more favorable views will henceforth be entertained of our State school of agriculture, and we will be surprised if in the future Allegan county is not more fully represented there.

ARMADA FARMERS' INSTITUTE.

The Institute at Armada commenced on the evening of January 11th, and continued its sessions during the following day and evening. Although the roads in the vicinity were in an exceedingly bad condition, the attendance was large, and an enthusiastic interest was manifested throughout the proceedings. The local committee of arrangements had done their work perfectly, and all the parties to whom the reading of papers had been assigned were in attendance and prepared to do their part, so that no deviation from the programme was rendered necessary, except what was caused by the absence of Profs. W. J. Beal

and A. B. Gulley. The time assigned to them was occupied by Secretary R. G. Baird and Mr. C. W. Garfield. The sessions of this Institute were ably presided over by Hon. Geo. W. Phillips, member of the State Board of Agriculture. Mr. Phillips conducted the proceedings strictly according to the programme, adjourning and convening the sessions without any motion of adjournment, and calling up the next order when the time appointed for it had arrived without any motion, thereby devoting the whole time to what was the proper business of the Institute. There were two excellent choirs in attendance, which contributed very materially to the interest of the meetings.

TUESDAY EVENING SESSION.

After singing and prayer Mr. Phillips made a few opening remarks expressive of his gratification on account of the interest taken in the Institute, and the pleasure which they all felt in meeting with the representatives of the Agricultural College who had come to aid them. He then called upon R. G. Baird, Secretary of the State Board of Agriculture, to address the meeting on "The Prospective Benefits of the Centennial Exhibition." This address is given with others following the record of the Institutes.

After singing an appropriate piece, Mr. Garfield of the Agricultural College was called upon, who gave an unwritten address on

THE APPLE ORCHARD.

The address was in substance as follows:

The most successful farmers in these days adopt some form of mixed husbandry as the basis of their operations, and upon this plan the apple orchard should occupy no subordinate place in arranging the crops for the farm. It helps to make a good living, first, by furnishing the family with a supply of healthy material for food; second, by supplying a crop which is ready of sale, and a valuable source of profit.

The usual neglect of the orchard is sufficient excuse for any one interested in fruit culture to strive by words and actions to keep constantly before the people the most approved methods of culture, and management of fruit after it is grown. There are great varieties of soil and climate with which we have to deal, hence the necessity of keeping prominently before the people the most successful practices among fruit culturists.

One important consideration is often left out of our instruction in fruit-growing, viz.: the way of growing healthy nursery stock, and the most approved methods of propagating young trees. Success in apple orcharding demands of us that we know how the trees are handled in the primary department. It is here that natural tendencies first show themselves, and where the adaptation to habits of growth must begin. For instance, the apple orchardist should know that there are good varieties, like the Red Canada, that to do well in the orchard should not be grafted on the root, but some distance from the ground, on a healthy, vigorous stock.

In planting, very few varieties are required to be most successful, and these should be chosen from the "iron-clad" varieties, and from stock not above two years old.

Trees should be purchased, if possible, at the nursery where they are grown, and the nearer home the better. Those who simply deal in trees are usually unprincipled men. In truth, the terms tree-dealer and liar are getting to be interchangeable ones.

A great deal depends upon the preparation of the soil for the trees before they are planted. Drainage and thorough subsoiling are necessary except in the lightest soils; and a fact never to be forgotten is that apple trees require to be fed as well as cattle and sheep to be profitable.

In the planting of an orchard the direction of the prevailing winds should be a point of consideration, and the trees should be set leaning slightly in that direction. Stakes of considerable size may often be employed for a double use. They will serve to tie the tree to, and if driven upon the southwest side, will shade the body of the tree from the effect of the sun in winter, which does its blistering work about two o'clock in the day.

Protection is a matter of paramount importance in the selection of a site for an orchard, and in arranging for its health and usefulness afterward. High ground has great advantages, because experience has taught that atmospheric drainage is an important matter to look after as well as drainage of the land. Timber belts, planted on the side of the cold winds, are a protection, when they are not too thick, so as to keep the air from moving, in which case danger may be apprehended from late frosts in the spring. Again, a very important item in the matter of protection is the one of having some covering for the ground about the trees. In many instances, during the past few years, when so many trees have been ruined by the severity of the cold, others have been saved by a little grass or a few weeds scattered through the orchard and about their bodies.

Pruning, like the training of a child, should be begun at the first, and not neglected for any reason. Then there will never be the necessity of removing large limbs, which is so suggestive of barbarism. By this method, nothing in the way of a cutting implement, larger than a knife, will ever be needed in the orchard.

The eye of an eagle after its prey should not be keener than that of the successful orchardist in looking after the insects of all sorts that delight in the destruction of his hopes. The most approved and latest devised methods are heralded abroad through the agricultural press, and the fruit-grower who looks well to his highest interest will be thoroughly conversant with them.

By all means plant apple-trees. Plant them for profit, that you may have the wherewithal to use elsewhere; plant them for the conveniences of the table and comfort of the family circle; plant them for the pleasant associations that are inseparably with the orchard, which is ever remembered by the members of the family as the most cheerful and pleasant accompaniment to the old home.

Following the address a number of inquiries were propounded to Mr. Garfield. The answers elicited an entertaining discussion. A few of the queries and answers are given:

Question.—What time in the year do you recommend for pruning?

Answer.—I believe, as already said, in pruning at all times in the year with a knife, and the orchardist should never go through his orchard without his knife, to remove any branch that is leading wrong. If a neglected orchard is to receive a heavy pruning, my choice of time would be when the sap is in full flow.

Ques.—How high would you train the bodies of trees?

Ans.—If orchards are cultivated, about five feet; if managed by mulching and top-dressing, three feet. The former plan I like the best.

Ques.—What do you think of the Baldwin apple for Michigan?

Ans.—It has proved to be not sufficiently hardy to endure the severity of our Michigan winters. Everywhere we hear complaints of the fearful effects of the weather upon the Baldwin orchards.

Ques.—You recommended a ground protection for the trees, and mentioned weeds in that connection. Would you favor allowing weeds to grow promiscuously among our trees, thus giving the orchard a slovenly appearance?

Ans.—Yes, rather than not have any surface protection. Cultivation should be suspended by first of August, anyway, so as to give time for the wood to harden for winter. I would advise the sowing of oats or buckwheat or some crop, at the last cultivation, which should remain on the ground as a protection, and also serve to keep the weeds down.

Ques.—Why do you advocate planting two-year-old stock?

Ans.—Because at that age the trees do not lose much ground by transplantation, and they are in such a form as to leave the management of the head entirely to the orchardist, while if older trees be purchased the pruning may have been taken in hand by the nurseryman, and the head formed at the wrong place.

Ques.—How far apart would you plant the trees?

Ans.—Forty feet each way for ordinary varieties. For small growing sorts, like Peck's Pleasant or Wagener, two rods or even less might answer; but if well grown, Baldwins, Greenings, and Spies will cover the whole space at forty feet, when they come into bearing.

The above discussion and music by the choir closed the evening session.

WEDNESDAY FORENOON.

The first thing on the programme for Wednesday morning was a paper by Mr. Lucius Palmerlee of Bruce, on

MIXED HUSBANDRY.

Mr. Chairman:—With much reluctance I present myself to meet your call for a paper on mixed husbandry. Your selection is a poor one, but let us not despise the day of small things. Nature builds up great contrasts for our benefit. The subject given me is a very broad one in its scientific and practical aspect, and to my gratification has been handled with consummate ability by men, practical, keen in observation, and well versed in the sciences.

The great desideratum in mixed farming, or any farming, is keeping the soil in good condition for productiveness. It seems to have become a fixed idea that in handling the subject of mixed husbandry the comparative profits must be given, or the individual fails to handle the subject as it should be; but for my part I consider it a beaten track, and what every farmer understands well enough already. According to the present mode of farming, there can be no rule established which will apply universally, owing to the difference in soils and size of farms. Let every farmer manage his own farm subject to his experience and judgment; for if there is any better method comes under his observation than he has been following, he will readily see it.

The profits of farming depend upon demand and supply in a great measure, but full as much in judicious management in disposing of the surplus product by the farmer. The comparative profits of sheep and cows depend very much upon the course the farmer pursues. If I gave my experience, it would be in favor of sheep,—that is, a given number, according to size of farm. On my farm from 80 to 100 can be kept to advantage, and the most clean profit with the least labor of any thing on the farm; but overstocking the farm with them is disastrous. I keep but six cows, but keep them for the good living (as milk and

butter never comes amiss winter or summer, in the family) more than for the profit, considering the labor required the whole year round, but they constitute an important branch of mixed husbandry, and cannot be dispensed with. We have a large country to produce from, and our markets are generally filled; but when a scarcity occurs in any one branch we are apt to neglect others at our own expense. Success in our calling depends on being posted as to what branch the majority are neglecting. Wheat, corn, and oats can be carried over sometimes to good advantage, if the farmer is unincumbered.

A few words on the manural question may not be out of place. Formerly there was an idea prevalent at our agricultural department that the farm must be kept in good condition by the compost or forage of the farm exclusively. Clover was of no account whatever. This I learned by interviewing one of the former foremen of the Agriculture farm who lectured in our neighborhood. The statement which he made was, he would have enough of compost to do it, if he had to buy forage from his neighbors. The thought struck me at the time, "Rob Peter to pay Paul." I cannot believe that such is the case at the present time. The verdict of every farmer in the State (at least of intelligence) would be against it. The farmer who sows from 40 to 80 acres of wheat, and other crops in proportion, will say that all the manure of his farm annually will not dress 20 acres. It is one of the impossibilities to keep the grain farms up without the use of clover. Clover, used for manural purposes, gives us our best specimens of wheat,—that is when we turn it under, and do not remove it and exhaust the soil still more by so doing. The reason is obvious: it carries more potash back to the soil than any compost which we use. Such is the verdict of those who have taken an analysis of its properties.

As to the stock of our country, I would like to see the good qualities of all the thorough breeds, as they are termed, centered in one. True, it would require time to do it, but what a great convenience it would be for the farmer! Equally as much or more than combining all of the good patent improvements of reapers and mowers in one combined machine for all work.

Here I leave you to anticipate all that might be said on this point, for I trust your experience is your school-master. I must proceed, for my time is limited to ten minutes on this exhaustless subject. And here let me turn your attention into another channel: farming or mixed husbandry in a higher sense.

The field of mixed husbandry is broad enough not only for the labor of our hands, but the more pleasing and profitable exercise of the mind in learning the principles and operation of the laws of reproduction. We are not content to plow, sow, and reap, and repeat from year to year, and spend a long life in such a course, and regard not the laws of growth, so sublime in their operation, and essential in our calling. We have had our experience and observation in forming grounds for the working out a problem of great value to us, tracing matter from effect to cause.

Nature has a multiplicity of forms for our special benefit, and adapted to the law of our minds. She is continually inviting us into her work-house to view the materials which she uses in constructing and reconstructing in variegated forms. If we understood the nature of those elements, and the laws of their combination, failure would seldom be written upon our labors.

To show how near we arrive at the point in question, we instance one thing that all are familiar with: In grafting we take a slip from the sweet bough tree, and insert it in a stock which produces the most inferior fruit of the apple kind; but the graft, when it comes to bear, gives us the sweet bough. The

fluids of the tree which received the graft are the same, but the woody structure of the scion is not the same, for the absorbents take up and combine elements which, coming in contact with the oxygen taken in by the leaves, produce the sweet bough still.

Farmers, I do not consider there is any danger in our knowing too much, for

"Shallow draughts intoxicate the brain;
Drinking largely sobers us again."

What masters or teachers shall we put ourselves under for instruction in this great work of progress in our calling? I am aware that what is said is directed to an intelligent class of farmers, whose experience is more than mine, although I have followed it in this State and Territory since 1832 without intermission. Looking upon you in this or that light, I judge that your management of the farm is all that it could be, taking into consideration location and circumstances generally. In frugality, domestic economy, good management, and care of domestic affairs, I yield you the award cheerfully.

Farmers, I acknowledge that more than half of my life has been spent in forms and the production of forms, by labor mechanically performed, for the profit of the thing in dollars and cents. But youth is past, and reproduction of forms, beautiful as they are when perfect, and however essential for the support of our organic structure, I place less importance to that essential than to the law by which the elements in nature are made to assume form. Let us become better farmers by learning the science of farming, and reap what gold and silver cannot buy.

Wheat is considered of the first importance in mixed husbandry, by all farmers whose soil is adapted to its growth. The question is often asked (in some localities), What shall we do to arrest the gradual deterioration of soils for raising this, the most prominent cereal? It seems to me this need not be so. There is a cause for it; let us enquire wherein it lies. Our new soils produce the most perfect specimens, hence we draw the conclusion that soils, new, possess the required elements for such a result. Is it mismanagement or too much management that causes the deterioration? Forcing the ground is too much management, while injudicious handling is mismanagement, in more ways than one. We may over-task our beast of burden by violating the law of his physical structure, to his utter ruin, and no restorative can make him good. We may render our farms unproductive and almost worthless by exhausting the proper elements for growth. There is a difference between the organic beast and the mineral earth, for time will restore the latter to its normal condition or productiveness.

Farmers, you will indulge me in asking a few questions: What element or elements are the most likely to be exhausted from soils naturally adapted for wheat-growing? Is it the nitrates of potash, or any of the alkaline properties? How are they generated, or replaced if volatilized by heat and escape into the atmosphere, or do they return from the atmosphere by absorption? Our experience teaches us that lime is one of the essential minerals in a good wheat soil. Limestone holds a given amount of carbonic acid. In what manner is it disintegrated or volatilized for the benefit of the plant? Those of us who have seen lime kilns in burning have discovered the gas emitting from the top, and when it ceases to volatilize the stone is sufficiently burned. By heat the carbonate is separated; then we use it for the benefit of the plant, where the soil is found lacking in this substance. Do the solar rays, acting on this mineral or calcareous substance, produce the same result? We learn that before it is available

for plant food the carbonic acid or fixed air must be removed before it is made soluble.

The volatile alkali, ammonia, that transporting agent, carries up the necessary element, the absorbent vessels take it, putting together two distinct principles, and the result is a something distinct from either,—perhaps the next combination is the product in the kernel of wheat. I give this overly condensed view of one particular thing of the many connected with mixed husbandry, in order to show that it behooves us to act intelligently for more than one consideration.

My observation in rotation of crops I will give, and perhaps some present may have had like experience. A field on the old homestead, noted for its good properties of soil for wheat or any other crop, was seeded to clover. The next season a heavy crop of clover hay was cut. The second growth was remarkably heavy; left for seed, but it lodged, held green, and was left uncut. The next season it was turned under and planted to corn. Gave the best yield the farm ever produced,—nearly 150 bushels per acre. The next season was sown to oats; result a magnificent one. The same fall sown to wheat; a very meager yield followed,—say less than half when summer fallowed, and not so good in quality. You may say that more profit was derived from the corn and oats, in the rotation, than the loss in the wheat. Admit it; but let me ask you what were the consequences? The course in rotation was too drastic, and it has not recuperated sufficiently in several years now to give as good a return as formerly.

There is such a thing as forcing the ground, and we understand it better than that favored people who were told not to do it. In the end there is a loss. Nature is not precipitate, outside of her laws, in restoring, although we may become co-workers with her. Here, again, we see the need of something more than a practical course,—call it scientific.

What elements were exhausted in that soil, that it refused to yield as formerly? Was it alkaline properties, nitrogenous substances, phosphates, or phosphites? There is a call for our understanding the working agents in nature better than we do. A good mechanic understands the laws of mechanics; let us understand the science of farming. Whatever branch of mixed farming we choose to make a specialty of, properly conducted, involves the principles of scientific farming, only in a more restricted sense, while mixed husbandry opens a broader page of the book of nature,—gives us variety,—gives us a boundless field for inquiry, always pleasing, not monotonous, but coincides or meets the law of mind.

Whatever of a special character we undertake, something more than observation is now demanded. We may feed our horses, cattle, and swine injudiciously for perfect development, and retrograde is surely written in legible characters upon the structure. And so with the vegetable. In our great liberality we may feed to excess and have a like experience. For example, I have a desire, as many do, to perform something worthy of note; select a piece of ground, put on thirty or forty loads of manure per acre, give it good cultivation, sow it to wheat. Everything is auspicious; a luxuriant growth in the fall, opens well in the spring; at harvest time, straw enough for 60 bushels per acre; thirty bushels of wheat per acre, quality medium. Counted a success in dollars and cents. Put that wheat to the test by analyzing its properties as compared with perfect specimens, and we would be obliged to write retrograde on the top of success. Evidently there is a deterioration in that wheat,—sufficiently so to preclude its

use for seed. But we have no time for a reasoning process. Perfection is what must be sought after in our calling as in all others. Such wheat is diminished in its germinating or vital forces, and runs out, as we term it. A thorough knowledge of the laws of growth enables us to produce a perfect specimen, and that would be a sure cure.

Many who are employed in agricultural pursuits build up fortunes; others, a competence for all their wants. But circumstances alter cases. The farmer who has a farm of three or four hundred acres is accredited as thorough, a good manager, intelligent, because he succeeds. All this may be true, but he has advantages over one who has 40 or 80 acres, over and above the difference in acres. He can keep from two to three hundred sheep, and cattle in proportion; can use one-third of his land for crops to good advantage; the remainder is resting for the plow-share, when in his judgment what is already in use needs to be stocked and rest for future use. Why should he not prosper? If he does not prosper, he has no claims for intelligence, frugality, or good management.

The farmer upon 40 or 80 acres who supports a family, rears and educates them, is worthy of commendation. His resources, comparatively, are small. The danger lies in drawing too heavily from his soil out of necessity. Twenty-five acres to grain out of 80, deducting ten for wood, is all he can use annually, and keep his farm in a proper status or condition. He must be frugal, a good manager in domestic economy, intelligent and self-denying, or he will make a shipwreck of farming. But thousands do it, and we give them the credit they so richly deserve.

In concluding what I have to say to you, farmers, the signs of the times are ominous. The interest manifested on this occasion speaks of an uprising,—a turning of our thoughts into channels which lead to the goal of triumph. The farming profession is becoming more popular, as science steps in and develops the vast resources in the storehouse of thought, the promoter of ideal development. The arts and sciences are hand-in-hand friends. Our profession is an art as well as a science. What is cheering to us is, that professors of a college are inviting us to unite our forces with theirs, both mentally and physically, to bring forth such incalculable benefits for ourselves and the world. They propose to use the means in their power,—superior scientific attainments in connection with a chemical laboratory,—to unlock what is hermetically sealed from our view.

It seems like anticipating what is to be in the future and future wants. Let us not bequeath to our posterity barren lands. It would be a rank injustice. Before another centennial our country will number its 200,000,000 of souls. Then the resources of husbandry will be taxed for home consumption. The science of farming must keep pace with the ratio of increase in order to meet our wants.

Some of the questions and answers which followed the reading of this paper were as follows: *

Mr. Ingersoll.—What has been your experience in feeding out the products of the farm and employing the manure upon the land?

Mr. Palmerlee.—I would confine the spreading of the manure upon one or two fields, where the weeds can be controlled. The rest of the farm should be kept up by green manuring.

Mr. Sutherland.—What is your experience with regard to the use of lime in promoting the growth of wheat?

* There being no short-hand reporter in attendance at this Institute, the discussions are reported very imperfectly, and in some instances not reported at all.

Mr. Palmerlee.—Lime and other substances, if rendered in soluble form, are good for wheat. Plaster is a stimulus rather than a manure.

Mr. John E. Day of Bruce was next called upon, who read the following paper:

SHEEP VS. COWS.—COMPARATIVE PROFITS.

The ultimatum of the skill and enterprise of average humanity is money. Prospective of dollars and cents, or the comforts which they are supposed to command, furnish the incentive and the object of our study and toil. Hence the word profits in our title. In the anticipation of the genesis of any new enterprise, the first question which meets the enquirer is, "Will it pay?" and when two branches of industry are brought into comparison, the same question assumes a difference only in form—"Which pays the best?"

But notwithstanding this, individual taste and preference have much to do with individual skill in any vocation. The man who would willingly walk a mile to kick a sheep will succeed but slowly in the trade of sheep-husbandry, and the man who can see no beauty or comeliness in the well rounded form and quiet look of the well-bred cow, will never make a successful dairyman.

In my remarks upon this subject I shall not deal with exceptional cases, but with the average profits of our average farmers. I have in mind at present more than one sheep-raiser who has established a reputation upon long years' practice as a careful and successful breeder and keeper of sheep, who, under present circumstances, would exhibit the height of folly to even anticipate any change; and so, on the other hand, the farmer who has made the breeding of cattle a study for years had better maintain the even tenor of his way, unheeding aught of change. But these are exceptions. The rank and file of our agricultural army are ready to take up that branch of industry which seems to pay the best for the time, and to stop it when such ceases to be the case. We welcome change perhaps a little too warmly.

Two aspects of the subject before us have set the public mind to thinking upon the question of comparative profits of them more intently than usual, especially in our locality. First, the dulness of the market for heavy wools the past season has dampened the ardor of many an enthusiastic wool-grower, and led him to conclude that if this is to be yearly repeated some other branch of agriculture must be taken in its place. Second, that our farms are in need of more manure than is accorded by the present system of sheep-raising. The attention of our members of clubs and granges has been already called to these features of the subject, and so will be better prepared to contemplate them now.

Theory tells us that domestic animals require one-fiftieth part of their own weight in good hay or its equivalent each day in winter; and this is undoubtedly as nearly correct as any rigid rule can be. It will not suit all cases. The average of cows in avoirdupois is about 850 pounds, and that of sheep 85. On the above theory, ten sheep will equal one cow in cost of keeping. Yet our most practical farmers say that eight sheep will consume as much per day as a cow in winter, and more while at pasture. I shall assume a medium estimate in my comparison, or in other words eleven cows shall be made to balance one hundred ordinary sheep. And just here, let me remark, occurs the difficulty in making a comparison between any two branches of agriculture,—our practices differ so widely, and we each draw our conclusions from our own stand point, and base our estimates upon the results of our own practices. One farmer loves his cows neither too wisely nor too well, but bestows upon them more care and ex-

pense than upon his sheep, and it is not surprising that they should yield the best returns. Another bestows his care and labor upon his sheep, and neglects his cows, and the meagre supply of milk, and the leanness of his larder, convinces him that the royal road to fortune lies in his flocks. The best we can do is to keep within the range of the old standard that thirty pounds of flesh requires one pound of good hay, or its equivalent each day, varying somewhat according to the class of animals under consideration and surrounding circumstances. Upon the basis of eleven cows to one hundred sheep, let us now proceed with our estimates. One hundred sheep cost, as to original investment, $250. They will average six pounds per head at forty cents—$240. The increase will be thirty lambs at $2.50 per head—$75 plus $240 equal $315. Deduct from this shearing and marketing $20, for tagging and washing $10, use of ram $5, equals $35, minus $315 equals $280 income of the flock.

Eleven cows cost, as to original investment, $440 or $190 more than the sheep. The average yield of milk per day through the cheese-making season just past, has been about twenty-two pounds per cow. The season has been a very poor one, both in pasturage and in the manner in which our farmers have been prepared to meet it. Twenty-five pounds per day is a fair estimate. The yield of the cows per day would be 275 lbs., worth at the factory $2.75. The usual length of the season for cheese is 150 days, which multiplied by 275 equals $412.50. At the close of the cheese-making season, the milk may be turned to the manufacture of butter. They will give ten pounds per head for 150 days—equals 16,500 lbs. of milk. Allowing twenty-five pounds of milk to one of butter would give us 660 pounds at 25 cts. per pound, $165. Again, eleven calves we may value at $30 and offset the buttermilk against the labor of churning and caring for the butter. $412.50 plus $165 plus $30 equals $607.50. Deduct from this for extra work milking $50, for cartage of milk $25, services of bull $25, for interest on the difference in first investment $19, equals in all $119, less $607.50 equals $488.50 or $208.50 in favor of the cows.

RECAPITULATION.

SHEEP.	CR.	
By 600 pounds wool, 40 cts. per lb.	$240 00	
By 30 lambs, at $2.50 each	75 00	
Total		$315 00
	DR.	
To cost of shearing	$20 00	
Tagging, washing and use of ram	15 00	
Total		$35 00
		$280 00
COWS.	CR.	
By milk for cheese making	$412 50	
By milk for butter	165 00	
By cash for calves	30 00	
Total		$607 50

	Dr.	
To extra cost milking	$50 00	
To costage of milk	25 00	
To service of bull	25 00	
Interest on difference in cost	19 00	
Total		$119 00
Profits on eleven cows		$488 50
Profits on sheep		280 00
In favor of cows		$208 50

I have in the commencement of this article adverted to the subject of manure. Let us revert to it again. One hundred sheep, with ordinary care, will produce forty loads of manure. Eleven cows, stabled and bedded will produce eighty loads of equal value, if the cows are fed a little meal, and the manure piled under shelter. Although difficult to place a money value upon this eighty loads above the former forty loads, yet it is a consideration worthy of careful attention. In the older portion of our country, many farms are composed entirely of tillable land. In many of these fields the virgin soil is exhausted, and these which we depended upon in years past have disappointed us, and we feel that we must by some means renovate them. Of course other means may be employed, as by clover, or the fattening of cattle, or the use of foreign fertilizers. I refer to it only as a difference between sheep and cows.

1. Abortion and failure to be in milk, objections to the production of milk. In nearly all herds of eleven cows from two to five, are, in spite of the utmost care on the part of the herdsman, farrow. If these are cows of ordinary or inferior value, they may be readily fattened and their place made good or more than good. But it often happens that they are the most choice cows of the herd, and rather than part with them the farmer prefers to suffer the loss. Let us suppose the average loss from this source be three cows, the actual loss in milk would be equal to about two-elevenths of the income of the herd or $110.44. This is a loss which has always been felt in times past, and will certainly be felt in time to come to a greater or less extent. Let no one go into this business thinking to avoid it.

Second objection. Trouble of milking. This, to many a farmer, is the "lion in the way" of dairying. Few of us have any surplus help available, and the morning milking has to be done by men who would otherwise be at the plow or other important farm work; and at night, long before sunset, the farmer himself, or the man, has to hasten home to milk the cows. The morning hour must be taken from the farm work, or else from the farmer's sleep, and we all know how dear to the weary frame is a little more folding of the hands to sleep in the cool of a summer's morning, and how reluctantly we leave the couch and seek the yard; and then we dread the thoughts of an hour's exercise at milking after a hard day's work at the plow or in the harvest field.

And then, perhaps one or two in the herd are restive and shy, and now and then extend the hinder hoof with a yank, and hinder the exercise of the caudel extremity with more than ordinary emphasis. Flies are thick, and gnats and mosquitoes are bloodthirsty. Again, one or more of the cows have been reasoned with by a former owner with such arguments as the stool, or clubs and bits of

rails, and need the constant presence of more patience than most of us possess, especially in fly-time. This is aggravating to the average human mind, and when, as often happens, it results in an overturned pail, and the consequent loss of pounds of milk which represent prospective dollars of income, it has a practice bearing which reaches not only the mind, but also the wallet. And oftentimes "the boys" to whom the milking is entrusted have an evening party on the tapis, and so milk the cows about an hour earlier at night, so as "to get ready," and in the morning, long after the usual time of milking, with eyes not yet half open, and in a fretful humor, they proceed to the yard to find the cows with their udders swollen and painful and as impatient as the boys. "The signs" are right for trouble. The milkers grumble like the mutterings of distant thunder, and upon the slightest motion of the cows the storm comes on, and is often such a one as leaves its effects for the rest of the season.

Most of us dread the thought of milking in winter. If cows are imperfectly stabled and poorly littered in the stalls, this is indeed a serious matter. With cold feet, and filth frozen thick to the animal's skin, the task is far from a pleasant one. But on the other hand, if the stable is a sufficient one and a good supply of bedding supplied, the matter presents a different aspect. Dairymen must remember that milking is a part of the farm work, and should be performed in the hours allotted to labor, and not after the farm work is done. Those who expect to have the milking done by hired men after a long day's work in the field, will not be likely to have it well performed, nor yet with a very good grace. Cross milkers make stubborn and ugly cows, while they diminish the yield of the milk. I am aware that in some families this work is performed by the female portion of the household. If circumstances favor it and the women are willing, this arrangement may be entered into in the summer season to the manifest advantage of the cows. But it is not practicable in the cold and snow of winter, and even in summer the women have as much hard work and longer days than the men upon our farms. I can appreciate the helpfulness of those women in most of our households who, in the stress of work occasioned by an approaching storm or some mishap, will cheerfully do the milking, and thus relieve those upon whom the stress has come. But I have no sympathy with the man who adopts this branch of enterprise because he can get so much more work out of his "women folks." This motive is ignoble, and he deserves to be disappointed. Again, many of our households are poorly prepared to take the addition to its daily labor of the manufacturing of 300 to 600 pounds of butter, neither are our pantry room and our butter appliances sufficient for it.

Third objection. Trouble of cartage of milk. This burden is usually borne by four to five neighboring farmers, who either alternate in the work or join in paying a man who makes this his business. In either case the expense is in proportion to the distance from the factory, the character of the roads, and other local considerations. He who is the most favorably situated in respect to the factory will of course deduct from his expenses a proper amount.

Fourth. Negligence in care is also a serious drawback to the enterprise. There is perhaps no branch of farm enterprise upon which the want of constant care shows so quickly, and with disastrous effect, as that under consideration. Irregularity in milking, feeding, insufficient or improper food, a scant supply of water or that of an impure character, are causes which lessen very materially the income of the dairyman. It will not do to enter the cheese making season, depending solely upon the pasture to keep up the yield of milk, but as the dry and parched days of the late summer, or the frosts of early

autumn come on, additional feed in some form must be given. The ride to the village or the call upon a friend in the early evening must be given up till after milking. Sunshine and storm, the same work is to be performed at the same time each day. Cost of fencing is also greater than for the keeping of sheep, and we may add to this fact that it oft occurs that one or more in the herd has but little regard for the works of man in this direction, and often leads the entire herd into mischief, which the value of many milkings will hardly make good. Additional expense of stabling room is also required. To many this is a matter of little moment, as they have buildings readily adapted to either cows or sheep, but to others the keeping of cows involves an outlay of greater or less extent in stables. I mention these as items to which attention must be given before we decide the question which pays the best. I have spoken of cheese-making only in connection with the factory system. If it is to be undertaken as a private enterprise and made up at home, the cost of cartage is obviated and the whey is retained home, to the evident betterment of the swine upon the farm.

Mr. Nims, of the township of Washington told me not long since that his dairy of fourteen cows yielded him $800 gross, above what was consumed in his family. Again, which is likely to be the most permanent employment? Are we not more likely to overstock the market with dairy products than with wool? Does either commodity depend for its market upon a local trade? All branches of honorable industry, like water, seek the level, and in the long run that business pays the best for which an individual's surrounding circumstances and his tastes seem to be the best adapted. We are too apt to rush to extremes. In our haste to be rich we lose sight of some of our most important influences. You who have read Victor Hugo's book, "Ninety-Six," will remember what a vivid description he gave of a cannon, which has broken loose from its fastenings upon the deck of a war-ship, and rushes with a frightful momentum this way and that, as the ship is moved by the waves, carrying destruction and death in every lurch. Such would be the effect upon agricultural commerce, if we all rushed blindly at whatever seems at the time to pay the best, only to change in another direction as each new fancy might direct. The interests of the community demand that all branches of agriculture for which our locality is adapted shall be fostered and developed alike. Present or prospective dollars and cents must not be the only consideration in the choice of our occupation. Will this or that occupation take up the time which might be given to "calm contemplation and poetic ease," of which our farmers know so little. Will this or that add most to the welfare and comfort of our families, as the comforts and refinement of home?

"Sheep-raising has had its ups and downs, like every other business, but it is a question if any business has paid better for a series of years. The rapid increase of sheep is favorable to farmers of small means who wish to engage in wool-raising. Sheep-raising is too much neglected in many localities. The animal which furnishes clothing, fuel, and lights for the world is entitled to more credit than it receives." It may be argued that other countries of perpetual vegetation or of milder interest can furnish us with wool cheaper than we can raise it. The same may be said of cows. Texas has been producing both wool and beef for our market for years, and yet our wool and beef commands a paying price. I have not spoken of the long or combing wools, nor yet of the distinctively mutton breeds of sheep. Perhaps more profit can be obtained from these than

the fine wools or their grades. If so, let their advocates who are here to-day proclaim it.

And now, thanking you for your patience in listening to me, I am disposed to end this article with the same idea with which I commenced it, viz.: Which pays the best? trusting that men of experience and success in other branches of industry here present will develop the matter more fully and with more intelligence than I have done.

Mr. John A. Paton of Armada was next called upon, who read the following paper on the

APPLICATION OF MANURE.

I will not speak at this time of the different fertilizers we usually have to buy, but of our common barnyard manure, of which we all have, or ought to have, plenty.

In the first place we must have our manure pile sufficiently rotten, and in the right condition to give nourishment to the young plants we expect to grow on the soil, or we need not apply it at all. If your manure pile is one-third straw and one-third cornstalks and cobs, you had better rick it over, and leave it in the yard until it rots, being careful to have it in such a shape that the heavy rains will not leach it. The usual time of applying manure is in the spring for corn and potatoes, and in the summer and fall for fall wheat. For corn and potatoes I would advise spreading the manure and then ploughing it under (but never throw in piles and leave any length of time). The cultivation of the young plants will bring the manure near enough to the surface. For fall wheat I would advise top-dressing by all means, whether summer fallow or stubble ground. Always plough the ground the last time before applying the manure if you want the wheat crop to get the benefit of it. After the ground has been ploughed the last time apply the manure, spreading it evenly over the surface, and then harrow it in.

I think fall the best time to apply manure, and that it should always be spread,—never left in piles to leach with the rains. I would apply manure after ploughing, before harrowing, for all crops, whether fall or spring, except for corn, potatoes, and root crops. But some will say, If you apply the manure on the surface after ploughing, the sun and wind will absorb the moisture and dry it up, rendering it useless. To such I would say, that manure will not dry out as fast as the natural soil, but on the other hand it will retain the moisture and keep the young plants growing. Of course, if you are going to spread straw on the ground, you had better plough it under to keep it from blowing away, for the only plant food there is in it until after it has decayed is what little liquid it has absorbed while in the yard. Some people draw the most of their manure out in the winter. If it is fit to draw (that is if it is sufficiently mixed and rotted), I think it is a good plan to draw it in the winter, when other farm work is not pressing, and it can be done without extra hired help; but it should always be spread,—never left in piles on the ground. As a general rule, however, the manure and straw that accumulate in the yard in winter should be mixed and rotted in the yard during the early part of summer, and drawn upon the land after harvest. Sometimes coarse, strawy manure can be applied to a stiff clay soil to advantage, but as a general rule, the finer and more rotten it is when applied to the soil, the sooner we receive the benefit therefrom.

AFTERNOON SESSION.

The exercises in the afternoon commenced with a paper by Mr. C. L. Ingersoll of the Agricultural College. Subject, "What Stock Shall We Keep?" See lectures given at the close of this record of the institutes.

After an interesting discussion which followed the reading of Mr. Ingersoll's paper, Robert McKay, Esq., of Bruce, was called upon, who gave an unwritten address. Subject, "The Farmer's Road to Success." We are sorry that we have not been able to induce Mr. McKay to write out his address for this report, as the theme was an eminently practical one, handled in a thoroughly practical and masterly way, by one of the most successful farmers of our State. The line of thought presented by Mr. McKay was substantially as follows:

He said: *First,* That the farmer must have a love for his vocation. Many he said took to farming because there seemed to be nothing else open to them, but having no love for their vocation they were restive in it and rarely if ever succeeded. *Second,* There must be mental and physical adaptation for farming. *Third,* Many fail because they attempt to grasp too much. Many a man might keep a country store successfully who could not fill the place of A. T. Stewart, so many a man might succeed on forty acres who fails on three or four hundred acres. *Fourth,* In farming, as in other things, intelligent labor is essential to success. The speaker, in a very interesting manner, referred to the many advantages which young men had in this country, and to the grand opportunities before them. With industry and economy there was no reason why they should not become wealthy. For his own part he would not be afraid to start out a young man poor, and be worth a hundred thousand dollars before his hair turned gray. We understand that this is about what Mr. McKay has done, and no doubt with his youth renewed he could do it again.

Mr. Thomas Dawson of Memphis was next called up, who read the following paper on

INCREASING THE FERTILITY OF OUR FARMS.

If I were asked to tell how little I know of farming, and of the best and most certain treatment of the soil to increase its fertility, I might make some showing, for I have truly and repeatedly said that we only grope our way along, for in the management of our farms we apply one fertilizer and then another, and wait and watch for the result, and if successful on one soil we repeat the trial on another, and again wait and watch, and find quite a different result: and we are led to ask, is there no certain management with certain results, or has the system of farm tillage no fixed or defined laws? If this were true we might presume that the Allwise Being, in his grand providence, had overlooked one of the most important provisions for the production of creature comforts, but we are not disposed to excuse our ignorance by finding fault with him who has done all things well. There is a means by which we can determine as surely the character of the various soils as productive or otherwise, which is as certain as the rules of the physician to prescribe the proper remedy for disease. By a proper knowledge of agricultural chemistry, soil can be analyzed, and the various properties, and their quantities can be determined, and by experiment and observation our learned agriculturists have found out the proportion of elements which constitute fruitful soils, and are enabled to direct us in supplying the needful element; but I am no chemist, and must stop here, contenting

myself with telling only what my limited experience and observation has learned me. We farmers know that there are various other means necessary to produce an increase of fertility of our lands, besides the application of fertilizers, such as full and complete drainage, either by underdrains or surface drainage, and a freer use of the plow, cultivator and harrows in mixing and mellowing the soil, and leaving it in proper order for the reception of the seed; and next in order is to get good seed, and to sow it a proper depth, for it is as great a mistake to cover it too deeply as too shallow; and I would add that in the use of those fertilizers, which we have found most convenient to obtain and to use in our locality, the barnyard manure is most important, and its application is never a mistake. Make the heap as big as possible and put it on the poorest lands, and give a top dressing as often as you can afford it of such green crops as clover, oats or buckwheat, and be as liberal in the use of plaster, ashes and salt as your judgment may dictate to you; and whatever you find will promote a greater growth of crop, use it. I will tell you one of my first lessons in farming which has always held good, and is as true now as when I learned it. I was hesitating in the use of plaster, having been advised that it impoverished the soil, and I referred it to an old farmer friend of mine, who answered: "If you grow nothing you have nothing to put on your land, and your land will get poor, but if you can grow something, and you put that something on your land, it will get rich." And I have found it true in every instance, and I make it a standing rule to use any means in my power to get the biggest crops, and the biggest mannure heap, and return it to my poorest fields as fast as I can, and I am then contented to leave the result to a good providence, who has promised a reward for diligence and industry.

WEDNESDAY EVENING.

The closing session of the Institute was devoted to an address by T. C. Abbot, President of the Agricultural College, subject, "Industrial Education," and the reading, by Mr. C. F. Garfield, of Prof. J. W. Beal's lecture on "Grasses and Forage Plants." Both of these lectures are given following this record of the Institutes.

The exercises during both evenings were interspersed with music. The attendance was large—extra seats were placed in the aisles and every available corner of the house. At all the sessions many of the farmers took a lively interest in the discussions, and at its close all who had been in attendance expressed themselves as highly pleased with the Institute and its results.

DECATUR.

The Institute held at Decatur, Van Buren County, commenced on the evening of January 13th, and continued its sessions during the following day and evening. The attendance was large. The town hall in which the sessions were held was crowded, and in the evening many were unable to obtain seats. Among the audience were many of the representative farmers both of Cass and Van Buren counties.

Here, as at Allegan, Armada, and in fact at most of the places where Institutes were held, the local committee had done their work so thoroughly as to secure a wide-spread and enthusiastic interest, and a highly profitable time. The High School choir furnished excellent music, which added greatly to the interest of the evening sessions. The same representatives of the State Agricultural College attended this Institute as did that at Allegan. The sessions were ably presided over by Representative A. B. Copley, who delivered the following

OPENING ADDRESS.

LADIES AND GENTLEMEN:—Some time in August last the State Board of Agriculture made arrangements to hold a series of six Farmers' Institutes, one of which was to be held at Decatur January 13 and 14, 1876. At a meeting called for that purpose, December 15th, 1875, in this place, the published order of exercises recommended for adoption by this meeting was made out, and if there be no objections it will be considered as accepted by the Institute.

This Institute is one of the first held by the professors of the State Agricultural College. The college was established by an act of the Legislature of 1855, and was placed under the care of the State Board of Education at first, and so remained until, by an act of the Legislature of 1861 the college was reörganized and a State Board of Agriculture created, under whose management the college has been to the present time. Winter meetings of the State Agricultural Society have been held several years at the time of the executive committee meeting, of a similar character to this, which were very interesting. The Illinois Industrial College held meetings in that State last winter of like nature, which must have been very instructive, judging from the published programme. The State Board of Agriculture of Massachusetts have held annual meetings for twenty-four years, lasting three to four days, the published proceedings of which fill quite a volume, and are a valuable acquisition to any farmer's library.

These meetings are held in many other States, being largely attended by the enterprising farmers within reach, with beneficial results generally.

The objects of the founders of the Agricultural College were to teach scientific agriculture, theoretically and practically. Also, to test different kinds of stock, grains, fruits, grasses, and vegetables; different modes of treatment, management, and culture; develop new theories, and confirm or explode old ones; thus proving by actual practice what had been theoretically taught in the class-room.

By receiving reports and essays from some of the most successful farmers of this and other States, the college became the repository of the most approved systems of farming, which, through its annual reports, were widely disseminated back again to the masses. Valuable as these results have been thus far, the State Board of Agriculture and college faculty aim to do better. As students to the Agricultural College, but few could have the advantages of its teachings, while but comparatively a small minority of the 146,300 farmers of this State could have reports to read. Some system was needed whereby the theories of science could be propounded to actual workers of the soil, illustrations shown, explanations given, objections answered, improvements suggested,—in short, a general criticism of the various subjects presented for the consideration of the Institute. Thus, while imparting information, not unfrequently would the benefits be mutual.

In this spirit it is to be hoped this Institute will be conducted, so that at its

close there will be no regrets except for its limited time of sitting, and that in the near future the seed here planted will yield "an hundred fold," and bear ample testimony to the wisdom of the Board in choosing this locality for one of the Institutes.

I doubt if there is any one place within the limits of our broad State, diversified as it is in soil, climate, surface, and advantages, where so many of the improvements suggested for the benefit of agriculture could be appreciated, and demonstrated by actual practice, as in Van Buren County; no county possessing a greater variety of soil, a larger capacity of production, or more extensive range of products; its soil varying from prairie, timber, openings, marsh, containing loam, clay, gravel, sand, muck, and combinations of either in many cases, render it a fit region for the practice of improved agriculture in all its endless variations. Situated in the very heart of the fruit belt, as our premiums, taken in a warmly contested State contest, conclusively show, not so near the head of Lake Michigan as to take the cold southwest winds without being tempered by the water, nor yet so far north as to be exposed to extreme cold from a high latitude, Van Buren county may justly, and without fear of contradiction, claim to have advantages not excelled by any of her sister counties. Possessing that rare combination of soils, timber, lakelets, surface, and protection that so eminently fit it for the production of winter wheat in perfection, is it any wonder that wherever Michigan wheat is known our own Keeler wheat is anxiously sought for, the better quality giving us better prices and more competition than our less fortunate neighbors? With a lake coast on our western border, giving our citizens, in addition to the protection afforded to the fruit interest, unusual facilities for water transportation of our surplus products, we have added to our other resources four railroads, which give us easy access to markets at all seasons of the year, to say nothing of projected roads, enjoyed prospectively without cost. That we have improved our opportunities, the statistics of the Michigan Central Railroad show. For the year ending May 31st, 1875, there were shipped 7,435 tons of freight from Lawton, and 9,767 tons from Decatur, not including 1,011 tons from White Oak and Mattawan,—18,213 tons total,—this station shipping more than any other between Kalamazoo and Niles. Favored as we are by the natural advantages of soil, climate, timber, location, together with our commercial facilities, it seems as if the one thing lacking to perfect our condition was the skill to avail ourselves of the rare natural resources a kind Providence has placed in our pathway.

For that knowledge which will assist us in overcoming our numerous insect enemies, draining our swamps and making available the rich deposits of muck therein, properly understanding the mechanical principles of farm machinery, and rightly educating our sons and daughters, we look to you, gentlemen Professors of the Agricultural College; and in behalf of the citizens of this village and of the farmers of the surrounding country, I bid you a cordial welcome. We hope, and shall try, to make your short visit here as pleasant to you as we know it will be profitable to us.

The importance of agricultural development to a community situated like ours can hardly be over-estimated. Nearly one-half the population in the State, and a much larger proportion in this locality are wholly dependent on agriculture, and the remainder are more or less directly interested. Our surplus farm products furnish nine-tenths of the money that pays for productions imported from other States and countries, and our farming population furnish over one-half of the consumers. Ask a commercial man what the prospects are

for business, and he will refer at once to the latest crop reports,—knowing full well that good crops furnish the money to buy from the wholesaler, and the ability to purchase from the retailer. Said Daniel Webster (and he never uttered a truer saying), "Agriculture feeds us. To a great extent it clothes us. Without it we could not have manufactures, we should not have commerce. They all stand together, but they stand like pillars in a cluster, the largest in the center; and that largest is agriculture." The science of agriculture is but in its infancy. Poorly as it is understood to-day, the average farmer of forty years ago would be wholly incompetent to take the place of the successful agriculturist of the present time. The shovel plow, bar-shear bull-plow, nigger hoe, and hand sickle, and the tramping-floor of Egyptian origin, have given way to steel plows of endless variety, cultivators, reapers, mowers, steam threshing machines, and many others, too numerous to mention.

More than manufacturers, who count cost of material, labor, transportation, and commissions accurately beforehand, the farmer has to take into the account other contingencies, as frosts, insects, drouths, floods, blights, and storms, before he can even approximate the probable profits of his crops. More than the merchant, whose customers are within a radius of a few miles, whose wants are known and supplied from week to week without failure or loss, comparatively. The farmer's customers are the whole world nearly; not only his customers, but his rivals also. The wheat-growers of Russia, England, France, Egypt, Australia, California, and many other countries are raising grain in direct competition with each other, and the value of their grain is fixed by the same law, that of supply and demand. The wool-growers of Australia, South America, Mexico, the European countries, and our own, all grow wool for the world's market, and the price depends on the amount of old stock on hand, the amount of the new clip, and the probable wants of the world. These three factors enter into an intelligent understanding of any kind of manufacturing, and as they are studied or neglected, in that proportion does the enterprise prove a failure or success. Farmers are manufacturers of the various kinds of grain, meats, wool, and other vegetable productions, and are governed by the same laws. If it is important for a manufacturer or merchant to study in detail everything appertaining to his business in order to be successful, it is equally so for the farmer, and much more difficult, for his customers and his rivals in business are scattered throughout the wide world.

If it is important for merchants and tradesmen to know what they are receiving for their business and what they are expending, it is equally important for a farmer to know where his money comes from, and for what purpose it is expended. Unless a farmer does this, he cannot tell whether his business is prosperous as it should be or not. Some of his crops may be very profitable, and others raised at a loss continually. An eminent writer says that nine-tenths of the failures in business occur from not keeping proper accounts. They do not know their own business, neither do the public who deal with them.

If it is important for a merchant to deal honorably, uprightly, and with strict integrity, it is equally so for a farmer to fulfill all of his appointments and engagements. Let us, then, strive together to elevate our God-given calling. Surely, where so much remains to be done, we can accomplish much in the future, judging from the vast strides made in our profession in the past. The time is propitious; it is the beginning of the year; the time for good resolves. It is the first of the College series of Institutes. It is the centennial year,—the dawning of a new century in our history; a marked epoch in our national exist-

ence. May this Institute mark a new era in our agricultural progress; an era in which science and practice shall go hand in hand, bearing a harvest of rich results.

The remainder of the evening session was occupied by Prof. A. J. Cook, who gave his lecture on "The Three Worst Insects of the Farm," followed by an interesting discussion. (This lecture and discussion, with others, is given following this record of the Institutes.)

FRIDAY MORNING.

The morning session was opened by Mr. J. R. Hendryx, who gave the following address on

ROOT CROPS.

The most important crop that can be raised by the farmers of Western Michigan is the root crop; and its great worth is doubly appreciated in seasons like the two past, when there was a great scarcity of hay. For many years I have grown, annually, a crop of yellow Swedish turnips, or ruta-bagas, and I have never failed of raising a very fine crop. Of course some years are more favorable than others for their growth, still very much depends upon the kind of land upon which your crop is raised. When I say it is the most important crop I grow, I mean that it is the best crop for the amount of labor expended.

In raising a crop of ruta-bagas, I insist there is but one sure way to do it. If the weather and season and everything else is auspicious, anybody can raise a good crop; but by following the directions which I propose to give here, you can have a good crop any season. I am going to raise a good root crop the coming season whether it is wet or dry, cold or hot. I never have failed, and if any of you will come to our place next season I will show you exactly what I tell you I am going to do. The grand secret in growing any crop is in properly fitting your ground, and the ruta-baga crop is no exception to this rule. If I could have my choice I would select an old June-grass sod, of light, sandy soil. If I could not have that, I would take a clover sod. The next thing I would choose would be a corn or potato field, well tilled the year before. On any such ground you ought to grow 600 bushels to the acre.

Soon after corn-planting draw on your manure and plow your ground. Then drag it lightly. Occasionally during the season run over it with the harrow, just enough to scarify the top and mellow the surface. Keep up the harrowing at various times until the last of June or the first of July. Then cultivate the ground as deep as you can without disturbing the manure. The turnip is a small seed, and if the ground is lumpy it will not grow. I take a couple of slabs about eight feet long, put the smooth, round side down, fasten them together, and then spike on a two-by-four scantling on which to hitch a team. On this lump-crusher I put a boy and let him go over the ground, which leaves it perfectly smooth. About the time for sowing I watch until I think it is going to rain, and then I drill them in perfectly straight rows, about three feet apart. I take great pains to have the rows perfectly straight, not so much for looks as for convenience in cultivating. We put in the seed tolerably thick, so the insects can have a little. After they are fairly up we run through with a revolving blade cultivator, just enough to scarify the top of the ground. You must not allow the weeds to get the start of the turnips. When the plants are up, thin them out so that no two will touch each other. Don't let the turnip stop grow-

ing a second until it is matured. When they are large enough to know that you are going to have a good stand, go through and thin out, leaving them about 16 or 18 inches apart. After this go through with your cultivator often enough to keep the ground perfectly clean, and I will guarantee that you will have a good crop of turnips. Last year we had two and a half acres, and by measuring two rows we estimated the yield to have been 2,058 bushels.

When I come to harvest my crop I cut the tops off with a hoe. I then put them in long pits, and cover well with good, dry straw, then put on earth not over six inches thick. In order to give them air, while covering I place sticks along on top of the heap every now and then, pack the dirt around them, and when I have finished covering I work the stick around, thus leaving a hole. I leave these holes open until the extreme cold weather, then I throw on a shovel of manure to close them, and the ruta-bagas always come out nice in the spring.

Some object to feeding turnips to milch cows, because they give a bad taste to the milk and butter. They might do this if they were stunted and strong, but my experience is that ruta-bagas kept growing rapidly through the season are free from that strong taste, and do not affect the milk.

DISCUSSION.

Mr. Rogers.—You spoke about keeping the ground clean. Is that the only thing necessary?

Mr. Hendryx.—I want to say in addition, when your plants get up pretty well cultivate deep and bring up the manure.

J. J. Woodman.—What kind of a drill do you use?

Mr. Hendryx.—We use a seed drill which my son purchased in Chicago. I don't know the name of it, but it does excellent work.

Mr. Glidden.—Any person can fix his farm drill so that it will answer every purpose in seed-sowing.

Mr. Hendryx.—A drill is not very expensive. Every farmer should have one to drill in his parsnips, peas, radishes, etc.

Joseph Gilman.—The last time you go through, do you turn the dirt towards the ruta-bagas or from them?

Mr. Hendryx.—I never turn the dirt toward the ruta-baga, and I don't want to take much from it. I should not sow my seed earlier than June 20, or later than July 7.

David Woodman.—What kind of ruta-baga do you find most profitable?

Mr. Hendryx.—I think the yellow Swedish turnip, or ruta-baga, the most valuable of any I have ever raised or seen.

Prof. R. C. Kedzie was next called, who gave his lecture on "Muck." This lecture, and the discussion upon it, are given after this record of the Institutes.

Next in order was an essay by Mr. Erastus Osborne, on

RECLAIMING WET LANDS.

In 1864 I bought a farm with a stream of water running across it, and skirted along on either side with low, wet land of various qualities, including the mowing marsh, poplar grove, willow swale, and all the briars and brambles native to low ground; and was accounted worthless, or nearly so, by most people. I commenced clearing the highest ground right away, and met with varied success, having no money, and what was of more importance, no knowledge of how the work ought to be done.

I found that the first thing necessary was to get rid of the water, so I commenced cutting drains, and soon proved the old adage, that "where there is a will there is a way." I dug the willows out of a swale and plowed it late in the fall, the water following the plow from one to four inches deep. I well remember one of our old farmers came along and said to me, "I would not plow that; it will grow up and be worse than ever." My reply was, "not while I live." Others said, "you will make it look better, but you will never get pay for your work."

The words of encouragement were few. I still live, and it *has* grown up to good crops, such as oats and hay, and at the present time there is no waste land to be seen along my creek as far as the old place extends, a distance of about 175 rods, though I lost time and money at first by not knowing the crops best adapted to such lands.

After experimenting three or four years I settled on a plan of my own, mainly like this: First cut drains sufficient in all cases to carry off the water rapidly, so in case of wet seasons it will run off as fast as it falls, and it must not fail to be all off the surface by the first of June, or your work will be thrown away.

There are many kinds of wet lands, and they want different handling. The mowing marsh is generally tough, and should be plowed in the fall and left to freeze through the winter, and it will be well rotted and ready for cultivation the next season. I would not seed to grass until the second crop, unless the ground is so soft that it is hard to work. I should recommend plowing all kinds of low ground in the fall. In a willow swale or thicket of any kind, cut with an axe a little below the surface, taking out as much of the root as you can handily. Poplar groves may be subdued in various ways. If they are small, pull them out. If they are large, it is easier, and I think cheaper, to cut them down, and fence in and pasture enough to keep down most of the sprouts for about three years, and the stumps will nearly all come out. Sprouts will spring up along the roots, but the stumps never sprout, and the roots become brittle, and break very easily with the plow.

In all cases where the surface is composed of bogs and a sort of spongy, mossy mixture, and filled with roots, if you can get a good burn the work is done. Should you fail in this, put a fence around it and keep sheep and cattle on until it becomes rotten, and what sprouts they do not keep down should be cut down every year in July or August, and they die and decay very soon. We have a large amount of low, wet, swaley land, covered with all kinds of timber and brambles, and water in spring and fall. In that class of land the large roots run on or near the surface to a great distance from the trunk of the tree, which makes it impossible to do anything with it. To reclaim this sort, cut the underbrush and then cut off the large timber. Let it lie until thoroughly dry, and burn. Fence in and keep stock on it, sprouting off annually what the stock fail to keep down, and by that time it can be plowed and seeded, and soon looks like old pasture. One word about making sheep clear land. My way is to fence in all such pieces and let them spring up green, then turn the sheep on, and let them live there until it is thoroughly eaten and trampled down, and then remove them to good feed. There is no need of keeping sheep starving on new ground all summer, and bring them to the yard spring poor in the fall,—a course which is both inhuman and unprofitable. You can subdue land and keep them on good feed four-fifths of the time, and have them fat in the fall.

I do not expect to enlighten many or much; but when I go about the country and see so many open fields disfigured by cat-holes that I know can be cleared so

easily with a few days' work, it makes me think some one ought to stir somebody up. All that is wanted is to *think* it can be done, and it will be done. Let me say to you who have one or more such blemishes on your farms, go at them now, while the water is low, and persevere, and before you know it they will be gone, and good crops will take the place of bushes and briars.

James A. Lee, one of my neighbors, had a few acres of low ground covered with poplar and cherry and grubs of all kinds, and also covered with water a great portion of the year. Having been previously drained, it was cut off in August, '73, of course when in full leaf, so that there was a great burden of litter on the ground, which formed an excellent bed for fire. After lying about one year it was burned. It was dug up a little with a plow and drag, and sowed with wheat and grass seed. The wheat (a very good crop) was cut last summer, and it now looks like old pasture land, and all in the short space of two years.

And now let me say to you that this reclaiming low, wet, marshy, shrubby land is not a play spell, and is much easier talked about than done. You will often hear men say that it is the best land we have, and all sorts of similar remarks, but were I to take my choice between good, grubby openings and the low swales of Michigan, I would take grubby upland; and I think I ought to have a choice, for I am pretty well used to both. I have followed the breaking plow and grub hoe for the last 25 years, more or less. My doctrine is that a poor man has no business with any more land, either wet or dry, than he can clear up and use. To pay $15 or $20 per acre and let it lie idle is murder in the first degree, financially. There are quite too many men in this county who are land poor, just because they are sleeping, and thinking that the money they have invested is going to double or treble while they sleep.

In August last I bought an old, neglected farm, containing some wet land which I directly set about draining. I asked my neighbor if he would let the water off if I let it down on him, and he said "let it come; I will take care of it;" and he did.

I cut a drain across, and without seeing another neighbor he continued it to the line between his land and mine, and then we cut another on the line; and in all, since I commenced work on the place, there have been over 400 rods of drain cut. And let me say right here, that it has all been done without the aid of township or drain commissioner, and I think that where ditching is required it is much better for those interested to do it mutually, and thereby save the expense of paying officers for locating, which sometimes costs nearly as much as the digging. It has been my misfortune, while collecting taxes this winter, to hear our supervisor most severely and unjustly censured on account of the drain tax assessed on our township, for which he was no more responsible than the tax-payers who abused him so unnecessarily. In my judgment our wet lands can be drained just as effectually, and much more cheaply, without the assistance of red tape or taxes.

One word about who can clear such land. A man must either have means to hire, or else not be afraid to get into the briars and mud, or to put his team into the mud; otherwise he will be quite apt to get discouraged in the beginning. I have spent the past two months in the swamp, and I am authorized to say that the work is hard, and the poison sumach worse than the work.

As to the first crop to raise on the low lands, I see now very plainly that if I had at first understood what crop to use I could have done much better. The past dry seasons I have raised very nice potatoes, selling them for three or four

years at one dollar or more per bushel. It is adapted to various other crops, such as turnips, oats, millet, Hungarian, etc., but the best crop, and the one surè to subdue the land quick and bring quick returns, is buckwheat. I should sow it every time. Indeed, I find it as profitable under the right conditions as wheat or any other crop.

There are many drains cut across open fields, and many more needed. The usual way, of course, is to shovel them out, but I think I worked out an improvement on that method last fall. I took the plow and commenced plowing the same as to plow around a small land, and after plowing and dragging it five or six times I scraped it back each way, using for a scraper a two-inch plank seven feet long, simply beveled off on one edge, and a hole through near each end to put in a chain, and fitted with two handles. After scraping, plow several times and scrape again. I think a ditch can be cut in this way for one-fourth the expense that it can be with the shovel, and it certainly is worth four times as much. You who may try this plow hereafter for the first time will be surprised to see how easily the work can be accomplished.

Mr. Howard S. Rogers next read an essay on

THE CRANBERRY,—ITS CULTURE, ETC.

The increasing demand, and high price which this fruit has brought in the past few years, has stimulated agriculturists into looking after the proper requirements for supplying the demand. Like all new enterprises and undertakings, it has been attended from the start with difficulties. These have occurred from the want of proper knowledge supported by experience, and as a consequence failure and disappointment have frequently been the result, while success, as a rule, has rather been the exception.

The reason for this is obvious to the most superficial observer; for like everything else that promises a large return for a small investment, it will find inexperienced enthusiasts who are ready to put in their last dollar and take the chances; and as a consequence many have abandoned cranberry culture in disgust. But the culturist who has set out with a determination to succeed, has only to remember that nearly every valuable product now raised on the farm has at some time or other been the subject of failure and speculation, and it would be a little singular if the cranberry did not have to pass through the same ordeal.

Varieties.

The cranberry family is divided into four varieties; or more properly one variety subdivided into four sub-varieties:

1st, The Cherry, which is the most common, and so named from its close resemblance to the fruit after which it is called;

2d, The Bugle cranberry, so called from its resemblance in shape to the bugle bead;

3d, The Bell or Pear shaped cranberry, so called from its fancied resemblance in shape to a bell or pear;

4th, The Small Gray, of irregular shape, and dark gray or brown in color.

Of the three former, for productiveness or quality there is but little choice, and that more in the eye and taste of the cultivator than any real distinction there is in them.

Of the small gray, although of similar habit to the others, in some respects it is entirely distinct. While it grows on a vine that cannot be distinguished from

the others unless in bearing, the fruit is smaller, less tart, and more filled with seeds. At the same time it is a good keeper, and the quality preferred by some. But it cannot be recommended for general cultivation.

Essentials to Success.

The four essentials to successful cranberry culture are, first, a bed of muck at least two feet deep, and no matter how much deeper; second, facility for thorough drainage; third, an ample supply of running water, with sufficient head to flow the whole ground at any and all times; fourth, an accessible supply of sand, the whiter and cleaner the better.

We put muck as of the first importance, not without knowing, however, that it is a mooted question, with some authors on the subject claiming that cranberries can be grown on almost any soil where any other vegetable growth will succeed. But I think this advice should be taken with a good degree of caution. The cranberry is one of the most tart fruits grown, and in order to grow it successfully a supply of the essential elements must be provided; and nothing, so far as our observation or experience goes, so nearly supplies this want as a bed of muck. While there may be locations on the sea-shore, almost wholly of sand, which, by its long contact with water and vegetable matter may have become so filled with acid as to form a good and permanent supply of this essential element in cranberry culture, I am satisfied that in the west our reliance must be on muck. We place

Drainage

as of next greatest importance, from the well-established fact that stagnant water is not conducive to vegetable growth or life, and in order to avoid it, as well as to have complete control of the grounds, the matter of drainage should be carefully looked after; and with myself, were all the other essentials perfect, and this one lacking, I should abandon the spot without a moment's hesitation. And in the selection of ground for a plantation, the first consideration should be the facilities for drainage. The next important element is

Water.

Although for the sake of order it is put in the third place of importance, in practical application it should be the first, for without it cranberry culture would be a failure; and however flattering in every other respect the prospect may be, without this my advice would be to let it alone,—or at most touch it with caution. With water the vine is stimulated to production, and protected from the inclemency of the elements, while the fruit, in its various stages of growth, from blossom to maturity, can be protected from its enemies, the fly, the worm, and frost, by the free use of water. And we would repeat again the importance of having an ample supply of water available, and at the command of the grower at all times. The fourth element,

Sand,

Should be what is usually termed beach sand, or the nearest possible approach to it, as any considerable portion of soil intermixed with the sand is conducive to the growth of weeds and grass, elements to be dreaded beyond all others by the cranberry culturist. Sand performs three important offices: the first of which is that it furnishes a fertilizing material important to the growth of the plant; second, by the radiation of heat, it assists in maturing, ripening, and

coloring the fruit: and third, by covering the ground it acts as a mulch, either choking out or preventing foreign vegetation from coming in. In the selection of a

Location

care and good judgment must be exercised, for with the best after-treatment on a poor location, the labor and care bestowed will be unproductive, and disappointment will be the result. The first point, of course, will be to secure a bed of muck, and the other essentials as accessible as possible. In the matter of selecting a location, if considered wholly in a commercial point of view,—that is, if it is undertaken with the one end of gain in view,—no one should be satisfied without having everything of the most satisfactory character. On the other hand, if the location is already an "eye-sore" to the farm, and its reclamation and planting is undertaken as much for looks and general appearance as prospective gain, an entirely different view should be taken of the subject, as pleasure is to be taken into the account as well as dollars and cents; and when the two can be combined, bringing all the elements necessary to success together, and at the same time reclaim an otherwise worthless swamp, and bring it into useful and profitable production, makes a double-paying investment.

After selecting a proper location, comes the

Preparation for Planting,

which, after grubbing, and the removal of logs, brush, etc., should either be plowed, or the sod removed with cart and spade from the ground, after which it should be covered with sand from two to four inches deep.

In my own case, instead of following this plan, I had the whole surface spaded over, from eighteen inches to two feet in depth, taking the sand, of which there was a supply from the bottom of the ditches. But this practice I would not recommend, as it is tedious, expensive, and no more effective than the cheaper and more simple processes. The greatest difficulty to overcome after turning over so deep, was the rank growth of weeds and coarse grass thrown up by the uncongenial soil brought to the surface from so great a depth, and requiring two or three years to subdue sufficiently for the reception of the plants.

Upon whatever plan adopted, let the preparation be of the most thorough character, as no future work will make up for a lack at this stage of the improvement; and after all the preparation that would be considered necessary by the new beginner, we would advise the thorough cultivation of still another year before planting, for the purpose of allowing the soil to become homogeneous, and killing out all the foreign vegetation that is possible. This extra pains is made necessary by the fact that after planting the vine grows so very fast that it is almost impossible to cultivate the ground without injuring the plants. After the preparation of the ground, comes

Plants and Planting.

In the selection of plants the grower should go the season previous to the natural bog where the plants are in bearing, or to those who have them for sale, and make his selection from bearing vines. While we have an almost unlimited confidence in mankind in general and cranberry men in particular, we would not, after going to the trouble and expense of preparing a plat suitable for planting, want to depend on *any man's word* for the reliability of the bearing quality of the plants to be used.

When the vines are on the ground, ready for planting, commence by making

shallow trenches or furrows three feet apart, and as long as you wish to plant, and in these furrows place the vines lengthwise, allowing the twigs to project upward, and at the same time cover the main vine an inch or so deep with your foot as you proceed along the furrow. It does not matter whether there is a root on the vine or not, as they will grow equally as well without as with. In fact, some growers recommend running the vines through a feed-cutter, and then sowing them broadcast; but this, in our estimation, would look rather slovenly and slip-shod for the progressive age in which we live.

As soon as the vines are planted irrigation should commence by letting on just water enough to keep the ground moist, and the plants in good growing condition. But little fruit can be looked for in the first two years after planting, and a full crop not until the end of the fourth year. In the fall, as soon as the picking of the crop is done, water should be turned on, and kept there until all danger of frost is over in the spring, and then, in case of a late frost or an attack by the worm or fly, immediate resort must be had to the water, and the whole surface flooded and kept so until the danger of frost is over or the enemy exterminated.

Harvesting.

In harvesting the crop it is best not to be in too great haste to commence, as fruit well ripened on the vine is of much more value than when picked before maturity; and by having water at command as recommended, the danger from early frosts is obviated, and harvesting can be carried along at leisure.

This facility of better ripening is the chief advantage of the cultivated berry over those grown on the wild marshes, while the latter have to be picked at the earliest practicable moment in order to secure them from outsiders, thus destroying their best quality both for taste and keeping.

In picking, the ground should be accurately staked off in convenient spaces for the pickers, and each one required to take an entire through, for if allowed full liberty they will be inclined to run over the ground to look for better picking, to the damage of the fruit and vines, and the general demoralization of the company. Women and children are the best pickers, and will gather on an average, where the picking is fair, a bushel a day to the hand.

Marketing.

As yet the local markets are hardly supplied with this fruit, and the taste of the people increasing each year, making a demand equal to, if not exceeding the supply. Like every other product, a great deal depends upon the manner in which it is put up for market. Many farmers will raise a fair crop of grain, but by the slovenly manner in which it is marketed they lose nearly all the profit there is in the crop, while others will take grain of a lower grade, and by better cleaning and preparation get the better price of the two. So it is with the cranberry: appearance has a great deal to do with its market value. Thorough cleaning, and the picking out of all soft or wormy berries, is absolutely necessary. Putting up in attractive packages is an advantage not to be overlooked, but at the same time let it be distinctly understood what the package contains, and never try to palm off a basket for more than it contains.

In conclusion, and in reply to many inquiries as to the profitableness of cranberry culture, I would say, that where all the requirements can be brought together in combination with brain and capital, and with a good stock of perseverance and patience, a fair return for the money invested can be looked for.

But let any one who contemplates entering the field as a speculator disabuse his mind at once, for there have been too many of that class at work already; while to the industrious, persevering man, who can be satisfied with fair returns, the field is a promising one, and well worthy of an investigation.

AFTERNOON SESSION.

The afternoon session was opened by Prof. R. C. Kedzie, who gave his lecture on "Lightning Rods." (See lectures and discussions following this record of the Institutes.)

Mr. R. C. Carpenter, C. E. of the Agricultural College, addressed the Institute on

FARM MACHINERY AND IMPLEMENTS.

Machinery of all kinds has been very much improved and very much changed within the last half century.

Fifty years ago mechanical inventions were few in number, rude, easily constructed, and producing even rough work only after a vast outlay of time and trouble. With the machinery of that day which was thought to be necessary to produce the few necessities of life, we find man nearly provided by nature.

In each house were found all the elements of an independent existence: the flax, the brake for dressing it, the little old wheel for spinning it, and the old hand loom for weaving it; the wheat, the flail for threshing it, the old fanning-mill for winnowing it, or more frequently winnowing it by throwing into the air, and often the pestle for grinding it.

The old method of haying, with all its tediousness, must still be fresh in your minds. You surely have not forgotten the back-aches engendered by the use of the old-fashioned, straight-handled scythe, nor the seeming insignificance of your hard day's work. In those days, mowing through, haying was nearly done; but even then many tedious days of work, turning and spreading the swaths and raking by hand, had to elapse before the hay was completely cured.

These are but few of the many inconveniences to which we were subjected a short time ago. Then our means of locomotion on land were confined exclusively to those given by nature either to ourselves or to animals, and on water we found our sole motive power in the winds or in our own muscles. Manufactories were at a low ebb, producing hand-made work at such cost as to prevent any extensive use. The introduction of machinery was at first greatly resisted. For instance, when it was introduced into the factories there was a terrible hue and cry from weavers at their hand looms, against the use of machinery, as taking their employment from them! You know how it is. More hands are employed to-day than then, and their condition is vastly improved. The introduction of machinery in their case, as in all others, improved the quality, lessened the price, and was the consequent instigator of a demand that knows no satisfaction.

We as a nation use machinery. It is estimated that $500,000,000 worth of machinery is employed on our farms alone each year, and with that machinery we do nearly every kind of work. We have machines in successful operation at all kinds of farm work; we have machines producing every kind of manufac-

tured article, and we have wonderful machines for locomotion either on land or water.

The very fact that there is so much money in our machinery has led many an unprincipled man into its manufacture. The country is literally flooded with worthless patent rights, and every collection of agricultural implements contains many got up utterly devoid of any mechanical principle. The smooth-tongued vendor of these worthless implements describes in glowing terms their wonderful qualities, and frequently will sell his implement where the less talkative dealer in more reliable implements will fail.

Much loss has been occasioned by overlooking the simple principles which govern the working of machines and implements, and a few have suffered themselves to be imposed on and deceived, when a simple and ready application of these principles would at once have detected errors, without resorting to an expensive trial. The day should be past for the commission of such blunders, as the man who thought he was favoring the weaker horse in his team by giving him the shorter end of the whiffletree; or of the other man who balanced the bushel of grain on his horse's back by putting the grain in one end and a large stone in the other; or of still another man, who, in order to rest his horse's back when riding to mill on the bag of grain, transferred the grain, without alighting, from the horse's back to his own shoulder. That the day is not past when less obvious blunders of the same sort are sometimes committed, is positively proved by the fact that many agents of worthless *patent rights* are every day growing richer. The principal reason for the community in general being so easily duped by the patent-right vendor, is on account of their ignorance of just the amount of work a machine should do. There are two great laws which, if thoroughly mastered, will protect the farmer in his purchases, and assist the manufacturer in his construction. The first is the "law of virtual velocity," or, in other words, "whatever is gained in time is lost in power," and *vice versa*. This, stated in another way, is, Forces are always equal when the products of the power, multiplied by the distance, are equal." You are all familiar with examples of the application of this law. If you take a straight stick, say three feet long, and put its center over a block for a fulcrum, it will remain at rest, or balance; that is, the forces acting on each end are equal. The same results will be true if you put a pound weight on each end; but if you move one of the weights six inches nearer the fulcrum the balance is destroyed. In the first case, supposing the weights to be each two pounds, and the distance 18 inches; you had, by the rule stated, power $\times$ distance $=$ power times distance, or $2 \times 18 = 2 \times 18$; while in the second case you had 2 pounds at 12 inches $=$ 2 pounds at 18 inches, or $2 \times 12 = 2 \times 18$, which is absurd. But you can make one pound balance two pounds by placing one pound twice as far from the fulcrum. This is true, both in practice and theory, for 1×18 inches $= 2 \times 9$ inches. You know that shortening the distance or lever arm has the same effect as the lightening of the weight, and you have here also learned that when one weight was lightened equilibrium was restored by a corresponding lengthening of its lever arm.

Now placing the stick with its center over the fulcrum and moving the end up and down, each end will move with the same velocity, for it will pass over an equal space in the same time. Moving the stick so that the fulcrum is twice as near one end as the other, the same motion gives one end (the one on the long side) twice the velocity of the shorter one, for it passes over twice the space in the same time; and by this we see that the velocity and the length vary the same, and consequently in any given expression we can substitute the one for the other.

You well know how you can make one pound balance two pounds,—or in other words, how a man weighing 150 pounds can raise any thing less than 300 pounds; but you notice that the lever arm on which he works is twice the length of that of the weight, and that he moves twice as fast, or passes through any given space in half the time that the weight occupies in going through. So it is with all machinery, from the simple grindstone to the complicated time-piece; from the horse pitch-fork to the steam locomotive. All recognize the great law that any increase of power is always accompanied by a corresponding loss, either of velocity or of time; and *vice versa*, any increase of velocity, and consequent saving of time, can only be done at the expense of power. An example of this last is seen in the steam locomotive. When the driver wishes to go faster he either reduces his load or increases his head of steam, which constitutes the driving power; but in no case can he increase his velocity without first increasing his power, or, what has the same effect, reducing his load.

The second law is that of *momentum*, whose powerful effects deserve a few remarks. Its great force is shown by such simple operations as driving nails with a hammer, or wedges with a beetle. The weight of the hammer with the strength of the arm added would not drive the nail, but the momentum,—that is, the combination of velocity and weight,—does the work in an instant. Inventors of machinery are sometimes much puzzled because of the failure of full-sized machines, where models have worked perfectly. They did not take into account the enormous increase of momentum caused by increasing the parts. For instance, if a model six inches long be made into a machine five feet long, the momentum of the moving parts will be 10,000 times increased. This fact should lead us to be cautious in the purchase of implements or machinery of any kind from seeing the work of a model. No new implement should be purchased without an exhaustive and satisfactory trial of a *working* machine.

Work of a Machine.

The sole work of a machine, whatever be its kind, consists in transmitting and modifying force or motion. There is no machine, nor can there be any, that will give any increase of both power and velocity. There are an endless variety of machines that will give a marked increase of one of these, but investigation will invariably show that this increase is accompanied by a corresponding decrease of the other.

In the yards of the copper-smelting works at Detroit there is a large crane, by means of which eighteen tons can easily be lifted by six men. Now the men do not exert over 80 pounds of force apiece, consequently we have 480 pounds of force lifting 36,000 pounds, or one pound of force lifting 75 pounds. But we notice another thing, viz., that it takes 75 revolutions of the driving-wheel to produce one revolution of the drum or wheel that does the lifting. Consequently, although the men lift 75 times as much as they could without the aid of the crane, they nevertheless are required to move 75 times as far.

The great advantage of machines is found principally in this one thing: they give us power when we want it, or they give us velocity when we want it. Of what use would velocity be in the crane? None at all; and it might even be damaging, as a body as heavy as 18 tons, moving with much speed, would be not only unwieldy, but positively dangerous. Again, in the case of the buzz-saw we need a great deal of velocity, and very little or no lifting power; but in order to get that velocity we require the united strength of ten horses.

Forces Utilized by Machinery.

Another great consideration is this: Machines enable us to perform useful labor with force that would otherwise would be of little or no account. To this class belong all our powerful and costly machines, including all those that move by steam power, by water power, and by electricity. If no objections, we shall increase this list, and include all those that are run by horse power; for certainly horse power would be of no benefit without some contrivance or machinery. The various animal forces, also heat, electricity, and gravity are made of practical utility to man only by aid of machines. Gravity gives weight to all bodies on the earth, and is the force which finally brings a moving body to rest, or causes a body to fall. It is gravity that causes the descending water of the torrent to tremble, to shake, to foam, and to move with the velocity of the lightning over the cataract; but it is only through machinery that this velocity and this power can be utilized and made to do the former laborious work of man.

Electricity is a force of which as yet but little is known, but by aid of machinery we magnetize hundreds and even thousands of miles of soft iron wire in an instant, and attract a bit of iron on the other end. We drop the key and the wire is as instantly unmagnetized, and the bit of iron on the other end falls, producing the familiar click of the telegraph sounder. Thus we make this subtle force a medium of conversation, and force it to be our principal means of rapid communication. Besides this use for telegraphy it has been made the motive power for engines.

Heat is not usually regarded as a force, though it is a well-known fact that as substances absorb heat they increase in length, or as it is usually said, "they expand." The principal use of heat in connection with machinery is in converting water into the steam which is the apparent motive power of the steam engine.

Though steam as a motive power is being used to a certain extent to run agricultural machines, yet, on account of the danger attending the use of fire, and also on account of the high salaries of skillful engineers, it is not probable that it will come into any general use for some time to come. Most of the motive power needful for agricultural purposes can come only from animal forces, and fortunately we have machines that may be run by applying these forces in a variety of ways. For instance, we have the tread power, which is run by the weight of the animal; the ordinary rotary power, in which the motive force is obtained by the animal pulling while walking in the circumference of a circle; and machines whose power is developed by the animal continually moving in one direction.

Action of Mdchines.

The action of a machine is to produce motion against a resistance. For instance, if the machine is one for lifting solid bodies, as a crane, or fluid bodies, a pump, the action is to produce upward motion of the lifted body against the resistance arising from its weight. If the machine is one for propulsion, as the locomotive, its action is to produce motion of a load against the resistance arising from friction and from gravity. If a mowing machine, the action is to produce such a motion in certain parts as shall overcome the resistance of the standing grass.

Lost Work—Friction.

Should we measure the amount of force transmitted to the mowing machine by the team that pulls it, we would find it considerably in excess of that needed

to give the requisite motion to the knives. As the knives move no faster than is necessary, this may not at first look reasonable; but I think when you consider how much of a load must be pulled, and how many pieces of machinery must be made to move before the knives stir, you will admit that there must be a great deal of lost work, for the only work that is effective is that which gives motion to the knives, and this we term the useful work.

There is more or less work lost in every machine. In the steam engine, 90 to 97 per cent is lost; in ordinary machines 40 to 90 per cent is lost, depending to a great extent on the character and construction of the machine, while in the turbine water-wheel, the most perfect of known machines, but 13 per cent is lost.

This lost work, that is, the work that goes into a machine but does not come out, is mostly used up in overcoming friction. The rubbing of wheel on wheel, the turning of axle in its box, or the slipping of band, all indicate a waste of power for which there is no complete remedy. The waste of power in friction may be greatly lessened, however, by a careful choice of materials, by skillful manufacture, and by the use of unguents. On the other hand, friction may be greatly increased by any unnecessary complexity (for example, in a mowing machine, by the addition of a couple of extra cog wheels above the necessary number), by bungling construction (as when the cog wheels do not fit nicely, or the axles are loose in their boxes), and by neglecting to apply unguents.

Unguents should be used wherever there is any sliding friction. This, of course, covers all cases where one body slides on another, and where one axle or other rod rolls in a box or in any stationary piece; but it does not cover the case of wheels that come in contact at their circumferences, or of the teeth in cog wheels, as in both these cases there is no sliding friction.

Unguents should be thick for heavy pressures, that they may resist being forced out, and thin for light pressures, that their viscidity may not add to the resistance.

Unguents may be divided into the four following classes:

I. *Water*, which acts as an unguent on surfaces of wood and leather. It is not, however, an unguent for a pair of metallic surfaces, for when applied to them it increases their friction.

II. *Oily unguents*, consisting of animal and vegetable fixed oils, as tallow, lard, lard oil, seal oil, whale oil, olive oil, and castor oil. The vegetable drying oils, such as linseed oil, are unfit for unguents, as they absorb oxygen and become hard. The animal oils, on the whole, are better than the vegetable oils.

III. *Soapy unguents*, composed of oil, alkali, and water. For a temporary purpose, such as lubricating the ways for the launch of a ship, soft soap made from whale oil and potash, with or without tallow, is the best of unguents; but for a permanent purpose, as for lubricating the axles, of railway carriages, it should contain more oil or fatty matter than soft soap does. The best grease for such purposes does not contain over 30 per cent of water.

IV. *Bituminous or Pitchy unguents*, which are now used so rarely that it is unnecessary to describe them, though the old tar bucket once had a conspicuous place under the axles of our wagons.

Unguents on Teeth of Wheels.

It is quite a common practice among threshers, and with some farmers, to apply tallow or other animal grease to the teeth of wheels. In any place where sand or other grit is apt to accumulate, as on a mowing machine or a reaper,

grease is a positive disadvantage, as the grit adheres to the teeth, thus wearing them very fast. Where there is no grit grease does no hurt, but it is at the same time an expensive luxury, as it does no good. With wheels properly constructed there is no slipping of the teeth on each other, and no sliding friction. Wheels whose teeth need to be greased in order to run smooth, are faulty in their construction, and should be avoided, as they indicate poor workmanship throughout the whole machine.

Workmanship and Material.

Perhaps no one thing is of more importance in determining the utility and durability of a machine than good workmanship. A conception absolutely perfect can result in nothing but a total failure if constructed by a bungling mechanic. With poor workmanship, the axles chuck and slip in their boxes, producing a tremendous waste of power. The same effect is produced by allowing nuts to loosen when working machinery.

Here is an apparatus designed especially to illustrate that point: You observe how easy it moves when the nuts are tight, and there is no slipping at the joints. But now let me loosen this nut: you see the difference at once. It requires so much force that I can scarcely move it, and very forcibly illustrates the need of close joints and tight nuts.

Another thing of great importance is the shape of the teeth in the cog-wheels. We perhaps will find more machines working hard from this one cause than from any other. Very frequently the tooth of one wheel will strike the tooth of another, pull steadily for one instant, rub and slide the next instant, and so continue until the whole machine groans and trembles. With teeth of such construction, grease could be used with positive advantage.

Teeth constructed as they should be wear equally in all parts, and each tooth hits its mate fairly and squarely, has no sliding motion upon it, and leaves it without a jar. The method of forming these curves of the cogs or teeth is quite complicated, and is founded on the following principle:

If a wheel were to roll on a board or other level piece, each point would describe a curve; starting at the bottom when the wheel commences to roll, it rises to the top of the wheel when it has turned half way around, and again sinks to the bottom when the wheel has turned clear around. This curve is called the cycloid, and is one on whose mathematical properties many an examination pony has been ingeniously composed and gallantly rode by the student of mechanics.

If we curve the line so that the circle rolls on the outside of a circumference, we shall have a similar curve called the epi-cycloid. If, on the other hand, we curve the base line so that it is concave toward the circle, the cycloid is varied somewhat in form, and is called the hypo-cycloid.

Now you saw that the cycloid was made by a wheel rolling on a straight line. The case corresponding to this in machinery is the ordinary rack and pinion; and we farther notice that if this curve is not given originally to the teeth of such wheels, they will soon wear into that shape.

In case of two cog-wheels working into each other, the curve becomes very much more complex, for in that case we have one wheel rolling on another, and also rolling inside another; and we find that the face or point outside *this* line called the pitch line, is epicycloidal, while that inside this line is a portion of a hypo-cycloid. It is to be noticed that these curves are not made by the pitch circles of the wheels, but by two imaginary equal circles.

Thus you see that even simple elementary portions of machines not only are of much importance, but they have been subjected to such close analysis that exact methods for shaping and proportioning them have been discovered. Though time permits no farther notice of shape and form of parts, science, in her application does not stop here, but extends her analysis and scrutiny to every piece, not overlooking the smallest screw or slighting the largest wheel. These points, unimportant as they may seem, are of vital interest so far as the working of the machine is concerned; and farther, these are not the only points apt to be misshaped by the workmen, but simple examples presented to show the degree of accuracy that is needed to make a machine work perfectly.

Another thing: you should always closely examine the material of which a machine is made. If of wood, satisfy yourself that it is made of varieties fitted to withstand the strains to which they will be subjected, and be sure that each piece is well seasoned and perfectly sound. Too much can not be said against the use of *green* or *unseasoned* timber. It shrinks in drying, utterly destroying all appearance of good workmanship, making the joints loose, and rendering the machine rickety and weak. Covering green timber with paint, is like filling a pit by covering with rushes and a few inches of dirt: it is a pitfall for the unwary. It conceals, but does not remedy defects. On the contrary, it prevents proper seasoning of the wood, and dry rot is the inevitable consequence. Your piece fails when least expected, and when most needed; perhaps a runaway and a broken neck are the dire consequences; but whatever they may be, you can not too carefully avoid the parricidal use of green timber for important pieces of machinery.

Iron of various kinds is now more commonly employed in machinery than wood, and from its greater strength and durability this change is attended with many advantages. Iron, however, is not free from defects, and each piece should be carefully examined for flaws or other failings. In general, the use of *cast iron* in machinery should be condemned. As it usually comes from our foundries it is very hard and brittle, and is entirely useless for any positions requiring much strength either to withstand vibrations or tensions.

Since cast iron is used in a great many cases, it is well to have some means of testing it. Engineers on public works use the following tests: When broken, the surface of the fracture should be of a light bluish-grey color, and close-grained texture, with considerable metallic luster. Both color and texture should be uniform, except near the skin, or surface, the color may be somewhat lighter, and the grain closer. If the fractured surface is mottled, either with patches of darker or lighter iron, or with crystalline spots, the casting will be unsafe. It will be still more unsafe if it contains air bubbles. As to appearance of good iron, it should have on the outer surface a smooth, clear, and continuous skin, with regular faces and sharp angles. The iron should be soft enough to be slightly indented by a blow of a hammer on an edge of the casting. Castings are tested for air bubbles by ringing them with a hammer all over the surface.

Objects and Designs of Machinery.

Soliciting agents meet you on every side, and claim the preference for, and endeavor to show how much benefit you will obtain, by buying machines whose vaunted capabilities cover every known qualification. You are shown single machines that will churn, wash, tend baby, sweep, pare apples, pare potatoes, mop, hem, tuck, broider, sew, knit, and everything else you can think of, for a

remarkably low price. Here is a model of one in which you can rock, go to sleep, and churn. Many believe in such machines, and the majority of farmers, I notice, are using combined reapers and mowers, which may in some cases be strokes of true economy, but in most instances the extra wear more than balances the extra cost, besides giving you a poor mower or a poor reaper the whole time.

No machine can do well different kinds of work, requiring different or conflicting capacities. All such attempts at combination invariably end in such a complication of parts as partially or utterly to destroy its effectiveness in any one direction, and make it more liable to accident in every direction. Simplicity is an essential qualification in any machine, as every unnecessary complexity increases the draft and the liability to accidents, thus injuring the utility of the whole machine.

We will consider for a moment the requirements for the reaper and the mower, and show that they can not both be satisfied in a combined machine. The work of the reaper is generally found on soft ground, which is more or less rough, and consists in cutting hollow and stiff straw, and carrying a portion of what it cuts some little distance; consequently the reaper needs strong driving machinery,—large drive wheels,—slow motion to the knives, and little strength to the cutting parts. On the other hand, the mower does its work on a good sod, over comparatively smooth ground, and its work consists in cutting very tough and fine vegetable products; consequently the mower requires light driving machinery,—light drive wheels,—fast motion to the knives, and consequently great strength to the cutting parts. From this you see that every essential qualification of the mower is entirely different from the corresponding qualifications of the reaper, and every attempt at combination can but impair its effectiveness either for mowing or reaping, or both.

Hon. M. L. Dunlap of Champaign, Ill., in the U. S. Agricultural Report of 1863, says: "He has never as yet seen a good combined reaper and mower, and would never recommend them thus made. * * * The six-feet combined reapers and mowers require four horses, and are much heavier, and will do but little more work in a day at best, as there are always more or less detentions with them. There can be no economy in thus combining the two machines, and if the farmer will look at the state of facts as they exist, he will never be induced to purchase them. Two hundred acres of grass may be said to be a fair estimate for the use of the mower in one season. The cost of a mower is, say \$80 00. The interest, repairs, and deterioration will be about \$25 00, or about ten cents an acre, assuming the machine to last ten years. We know one farmer who cut twelve hundred acres of meadow with four machines, drawn by two horses each, and driven by boys of fourteen to sixteen years of age. To have cut this amount of grass with combined machines would have required four additional span of horses, and expert drivers in place of the four boys. We do not think a combined machine would stand more than two seasons' work at this rate, when the account would be as follows:

Use of mower at 10 cents per acre	\$120 00
Four teams, 30 days each, 120 days	120 00
Four boys, 30 days each, 120 days	120 00
Giving total cost of thirty cents an acre, or	\$360 00

Four combined machines, $120 each	$480 00
Half charged to reaping	240 00
Half their value for one year	$120 00
Repairs and interest	20 00
Cost of *using* four combined machines one year	$140 00

Or if they are used to cut 1,200 acres of grass, it will amount to 12½ cents per acre. But the difference does not stop here:

Cost of using machines	$140 00
Eight span of horses, 30 days each, 240 days	240 00
Four men, 30 days each, 120 days	240 00
	$620 00

or 51½ cents per acre—nearly double that of the single mower. We think no one can cavil at the above comparisons. We say the above deliberately, after nearly twenty years' experience with the reaper, and fifteen with the combined machine and single mower."

Without doubt the experience of nearly every farmer substantiates the theory and the experience of Mr. Dunlap.

From one of the most complex implements we will call your attention to that valuable though simple implement,

The Plough.

Until late in the present century the wooden mold-board plough was in universal use. By the work of Mr. Jethro Wood of New York the cast iron mold-board was introduced, and a new era in the manufacture plows began.

Despite the invention of rotary diggers, grubbers, etc., it is not likely that the plow will soon be superseded. Its great leading feature is simplicity. It consists substantially of a single part, or is one solid, moving whole, although in its manufacture several parts are united together. This simplicity is of the utmost importance to an implement doing such work, subjected as it is to heavy force and to heavy blows. No complex implement can endure a constant repetition of such blows, and nearly all the complex substitutes no matter how ingenious, can but result in failure. Here are a few models of plows. Doubtless every one of them will work, some better and some worse; of their peculiar merits I have nothing to say. I have found, however, that nearly every man has a favorite plough, and since that plough does good work for him, though it may not work well for any one else, to him would I recommend that plough alone.

But I have already said too much, and I must close; hoping, however, that in a day not far distant, by means of a dynamometer, an instrument which we do not now possess, I shall be able to give you, through the press, some facts regarding the draught and strength of implements which will be of more immediate practical utility.

DISCUSSION.

J. R. Hendryx.—Did I understand the lecturer to recommend that we use no oil on our machinery?

Mr. Carpenter.—No, sir. I said that the cog-wheels should be so constructed as not to require unguents.

Mr. Hayne.—I understood you to say there was no friction on the teeth of the wheels. Don't they have to pass each other?

Mr. Carpenter.—If the cogs of two wheels work properly together there is no slipping or sliding to cause friction. The cogs merely push against each other, and about all the wear there is upon these cogs comes from the vibration of the machine.

QUESTION BOX.

Ques.—Does not the clearing away of forests and the drainage of swamp lands tend to lessen the amount of rain-fall?

Dr. Kedzie.—I am satisfied that forest growth has a marked influence upon rain-fall. It may not make any difference in the amount of rain-fall during the whole year, but it has a great influence, so far as my observation extends, in the distribution of the rain throughout the year. Where a country is denuded of forest trees it is thought to be more subject to frequent drouths. The question asked has aroused a corps of able observers, and George P. Marsh has written a very valuable work on this subject, entitled "Man and Nature," published by Wiley & Son, New York. The price is $3, and it is worth ten times that amount to any farmer in the State. In this book you will find a mass of information bearing upon this subject.

Ques.—I have several times found cut-worms with maggots on them. What were they?

Prof. Cook.—They were evidently the parasites of which I spoke last evening. When the cut-worm comes forth from the ground, the little fly which lays the egg for this maggot is ready to attack it. When the eggs of the little fly hatch out these maggots prey upon the worm, and literally eat it up alive.

Ques.—Do the farmers present disapprove of the use of the combined reapers and mowers, especially on small farms?

Mr. Curry.—I call for a vote on this question.

J. R. Hendryx.—Before using the combined machine, I would advise farmers to club together and buy two machines.

J. J. Woodman.—If it is merely a question as to the merits of single or combined machines, then probably the farmers will say single machines are preferable; but if the question of economy as well as use be taken into consideration, then, certainly the combined machine will get a majority of votes. Few farmers in Van Buren county can indulge in the luxury of two machines. I have used the combined machine for the past fifteen years with the utmost success.

R. C. Carpenter.—It is getting to be the custom in the eastern part of this State and in portions of Ohio and New York to use single machines instead of the combined, and I know in some instances where combined machines were formerly in use they have been discarded for the mower, and the reaping is done with the cradle.

Mr. Hendryx.—Has Mr. Woodman used both kinds of machines?

Mr. Woodman.—Perhaps not practically. I would much prefer single machines if the question of economy did not come into consideration, but on these 40 and 80 acre farms I don't want to see anything which will look as if we recommend that the combined machines should be discarded.

J. R. Hendryx.—If I could not buy two machines, I would induce my neighbors to unite with me before I would use the combined machine.

When the vote was taken there was a pretty decided majority for the use of combined machines in Van Buren county.

Ques.—Which is the most desirable; a summer fallow kept clear from grass and weeds, with frequent stirring and exposure to the summer sun, or to allow it to grow up to grass and weeds and then plow under?

Dr. Kedzie.—It depends very much on the nature of the soil. To answer the question properly, however, you must bring up questions which would furnish material for half a dozen institutes. A clay soil which is sufficiently supplied with vegetable matter would be benefited by clean cultivation, while the same kind of management on a sandy soil might be injurious.

Ques.—What is the best method of catching, killing, and preserving worms, bugs, and insects?

Prof. Cook.—That is a pretty long subject for five minutes, and better be postponed until there is time for a full lecture upon the subject.

Ques.—How late should ruta-bagas be cultivated?

J. R. Hendryx.—I would recommend cultivation as long as you can get through without injuring the tops. When your cultivator begins to break off the tops then quit.

Ques.—Does spontaneous combustion ever take place?

Dr. Kedzie.—My answer to that is that spontaneous combustion does frequently take place. In some substances oxidation is very rapid, and the heat becomes so excessive that fire ensues. Cotton rags soaked with linseed oil are often the source of spontaneous combustion.

Ques.—What is the difference between theoretical and practical agriculture?

Dr. Kedzie.—The office of the agricultural chemist is to explain the facts which the practical farmer finds out.

Ques.—Would the application of ashes to mucky soils improve them for grass, cereals, or vegetables?

Dr. Kedzie.—Ashes would be one of the very best things you could apply to your land, and if you have plenty of ashes and muck there is no limit to the capacity of your farm.

Ques.—Are plants indebted for any of their growth to any substance secured from the air?

Dr. Kedzie.—The plant derives a large portion of its carbon from the carbonic acid of the air.

Ques.—What is the comparative value of roots, beets and turnips of the different varieties, for feeding stock, as compared with corn?

Mr. Lyle.—In feeding stock for the market I prefer corn and ruta-bagas, with plenty of good hay. I have been in the feeding business 21 years. In handling cattle, when the pastures begin to get short in the fall I begin to use my corn, ruta-bagas, and hay, and in three months from the pastures I can generally have my steers good beef.

J. J. Woodman.—Have you ever tested the comparative value of ruta-bagas and corn for feeding sheep and cattle?

Mr. Lyle.—I frequently, when feeding corn so heavy, feed ruta-bagas three or four times in a week. Too much corn makes them feverish.

J. R. Hendryx.—How many bushels of ruta-bagas do you consider equal to a bushel of corn for fattening purposes?

Mr. Lyle.—I should think about four bushels of ruta-bagas to one of corn.

Mr. Hayden.—I never have had much experience in feeding stock, and do not speak from my own knowledge; but I recollect of seeing a statement in the

New York Times, claimed to have been based on actual experiment, which said that nine bushels of ruta-bagas were equivalent to one of corn.

Mr. Hendryx.—I don't think that test was made with the yellow Swedish turnip.

Mr. Morton.—I would inquire whether Mr. Hayden makes that statement as the result of a scientific investigation?

Mr. Hayden.—The tenor of the paper was to show by careful analysis the real value of these two articles of food.

Dr. Kedzie.—I don't consider that a mere analysis will determine the question of value. A large proportion of one kind of food may pass through an animal's stomach undigested, while another kind of food may be easy of digestion, and the animal receive the whole benefit of the food. The experiments of one practical agriculturist in this matter of feeding is worth more than the experiments of all the chemists in the country.

Mr. Lyle.—I know that you can go into the New York market and you will see droves of cattle from Canada which they claim are fatted on ruta-bagas; and I know no finer stock ever find their way to that market.

W. G. Beckwith.—I have never had very much experience in raising and feeding ruta-bagas, but, so far as my knowledge and experience goes, I think it a very expensive way for me to water my stock. I claim that in this country we can raise hay and corn cheaper than we can roots. If I was going to raise any root crop, I would raise "petaters."

[A voice.—Oh, my!]

Mr. Beckwith.—Mr. Lyle says that in Canada they raise their stock on ruta-bagas, which may be undoubtedly true, but they have extensive clover fields, and also raise a great deal of hay and corn. I claim that in Canada they can raise turnips a great deal better than we can; for there is hardly ever any year but what they are sure of a crop, while here there are many failures. There is another great mistake about feeding cattle: The same gentleman says they get feverish if you feed corn steadily. The simple reason is that they feed too much grain and not enough hay. One of the best feeders in Michigan told me the amount of grain he had fed his stock during the past 20 or 30 years, and I could hardly believe him until I saw the experiment tried. There is not one man in twenty but what feeds his horses double the amount of grain they require for their own good. Feed less grain, and more hay and straw. As far as turnips are concerned, I believe it costs more to raise two acres than it does four acres of corn. I don't believe they pay at all. As I said before, I believe "petaters" are cheaper than any other root crop.

J. R. Hendryx.—I am pretty tenacious on this turnip business, and I will say to the gentleman, if he will come to see me next fall I will show him as fine a crop of turnips as he will wish to look at. I consider four or five bushels of ruta-bagas equal to one of corn.

Mr. Dodge.—I would like to ask Mr. Beckwith how much grain his friend was in the habit of feeding?

Mr. Beckwith.—He said he fed two quarts of meal at one time to his cattle, three times a day.

D. Woodman.—I have grown ruta-bagas for the past two or three years, and I consider one bushel of corn worth as much as nine bushels of turnips. I would much rather raise hay and corn.

Horatio Hendryx.—Have you ever made any practical tests in feeding?

Mr. Woodman.—I never have.

Arthur Hayden was next called upon, who read the following essay on

CORN CULTURE.

Our knowledge of maize begins with the discovery and conquest of America by the Spaniards, who ruthlessly invaded and ransacked the country in search of wealth of gold and silver, little knowing they were trampling beneath their feet, in their eager march through the fields of Indian corn, the greatest treasure the new world held in store.

But some were observing enough to note the manner of its culture. Having no domestic animals, nor any knowledge of iron, the work was all done by hand, and with the rudest implements. The women, upon whom devolved most of the labor, dug up the soil with stakes hardened in the fire, and after the seed was planted all further responsibility of the crop was placed upon Dame Nature.

In these labors the women of the village all joined, and when autumn was come with sere and yellow leaf, they together sought the field, and husked and bore the grain to the common garner, where it was free to supply the needs of all. Under such conditions the crop was probably vastly inferior, both in quality and quantity, to the vigorous plant and bountiful yield of our more favored times. Having spread to other lands, still, as the child of America, it is found in greatest abundance and perfection in its native land.

It is the object of this paper to discuss very briefly the advantages and methods of its culture.

The true basis of successful farming is to secure from year to year larger crops at less expense per bushel, and an increasing fertility of soil. More bushels, less cost, richer soil. How does corn culture supplement the efforts of the farmer in attaining these conditions?

To raise large crops there must be immunity from weeds, and with no other grain is there such an opportunity for extirpating them, together with a thorough cultivation of the soil for the benefit of the growing and future crops. With a decrease in the prevalence of weeds, the cost of raising all crops is diminished and an increased production of all attained. Corn-raising tends indirectly to increase the fertility of the soil, because, being bulky both in stalk and grain, it is most profitably consumed at home, thereby returning to the soil the major part of the elements abstracted therefrom in its production. The raising of corn to the exclusion of other crops, and for shipment in a crude state, is reprehensible, but is likely to correct itself by reason of the greater freight upon the grain than upon the same converted into beef, pork, etc., and tends directly to stimulate the stock industries upon which the recuperation of the soil so largely depends.

These are, in outline, some of the advantages of corn culture. But to be an advantage at all to the individual farmer it must be raised at a profit,—which leads to a consideration of the methods of culture upon which, assuming natural advantages, the amount of profit depends.

In accordance with the fundamental principles of farming, that method is best which produces the most bushels at least cost, with increased productiveness of soil. The first essential to the raising of a large crop is, of course, a soil rich in the elements which constitute the food of plants; which presupposes an intelligent management and preparation of the soil during previous years, and a judicious application of fertilizers to the crop in hand.

Both experiment and observation seem to confirm the belief that the applica-

tion of plaster and other fertilizers to corn in the hill, while of apparent benefit in the early stages of its growth, will, if composted and spread with manure do more good with far less cost: for during the later growth of the plant, when the work of assimilation is at its height, the absorption of its food takes place mainly through the minute rootlets and still smaller root hairs, at a distance of several feet from the stalk, and reaches, if not prevented by an unwise cultivation, every portion of the soil.

With sod, or wheat stubble which was sod the year before, with a good coating of manure, which will do most good at least expense if drawn and spread in the winter, seems most favorable for a large crop; but, even with a favorable season, it yet depends upon the method and cost of culture, whether the crop is raised at a loss, or how great the profit may be.

To secure the best results the work must be well done and done rapidly, to which end the skillful hand, the strong team, the best of tools, and above all, watchful industry and well laid plans are essential.

Next in importance to enriching the soil is the reduction of cost; and upon this last depends, more than all else, the immediate profits of the farmer.

By way of illustration, a consideration of the cost of the various items of cultivation under different methods may be profitable. The cost of plowing 40 acres with three large, powerful horses, and plow of proportionate size, 12 days' work, at $3

work, at $3	$36 00
Cost with two small horses, 20 days	50 00
Cost of dragging twice, 12-ft. harrow, 2 days, 3 horses	6 00
Cost of dragging twice with 6-ft. harrow and 2 horses, 4 days	10 00
Cost of marking with 16-ft. marker, 2 days	5 00
Cost of marking with 8-ft. marker	10 00
Cost of planting by old method, with the hoe, 20 days' work	20 00
By using slabs for covering the work may be better done at a cost of	11 00
Cost of cultivating, 1 horse, 10 days, at $1 50	15 00
Cost of cultivating, 2 horses, 5 days	12 00
Cultivating 6 times, 1 horse	90 00
Cultivating 6 times, 2 horses	72 00

As a matter of curiosity as well as instruction, the number of miles travel by one method may be stated in round numbers at 800, by the other at 1,500. The cost of cultivation, in the aggregate, by the one method is $130, by the other $180. Leaving out of consideration the probability, amounting almost to certainty, of an increased yield, here is a saving of $50, or $1.25 per acre, due to strong motive power with implements of proportionate size. Taking the average yield of this country, this would be a saving of 4 cents a bushel, and upon its entire production of 1,000,000,000 bushels the sum of $40,000,000. Insignificant as this sum may appear in the case of each individual, it may determine whether he is on the road to affluence or bankruptcy.

As further affecting the cost of production, first fix the date of planting, and place it late in the season, so that the ground beyond question will be warm, the germination rapid, the growth healthy and uninterrupted. Defer plowing as long as possible, and when once begun work steadily and rapidly; drag thoroughly, mark accurately, and plant immediately, and then, if necessary, rest, with mind free from apprehensions of a struggle with frost and replanting, and weeds, a pale and sickly plant, and a scant harvest to close the melancholy scene.

While farmers are urgent in their demands for cheap transportation; while

they are indignant, and justly so in these times, at any increase of freights; while they rise almost in rebellion at a monopoly of warehouse privileges which, if they would ship their wheat in bulk, obliges them to pay 1½ cents per bushel for the privilege of running it through a hopper and a spout to the car below; would it not be wise, also, to study with like interest to save a few cents per bushel in the cost of production, by deeper study into the laws of nature, by improved methods of culture, by discussions, and carefully conducted experiments in granges and farmers' clubs, and meetings like the present.

Improvement should be the motto of the farmer, and we owe this alike to the memory of our fathers, who cleared and fashioned the beautiful farms which are our heritage; to ourselves, as custodians in the present, of the fair fame and honor and dignity of the noble profession we have espoused; and to that posterity who, when we have shuffled off the mortal coil, are to carry on the great work of development and progression.

DISCUSSION.

E. Durkee.—At what time would you recommend corn to be planted?

Mr. Hayden.—Taking one year with another, I would recommend the 20th of May as the time to commence. I think too much haste in this matter has caused a great deal of loss to the farmers of this community. Until the soil has attained a certain temperature seed should never be put into the ground; for, no difference how good your seed corn, it is bound to rot if it remains in the cold ground any length of time.

J. J. Woodman.—I am requested to ask Mr. Hayden a question, and that is, "Whether he ever saw a kernel of good, sound corn planted in the spring that did not germinate and grow?"

Mr. Hayden.—I am not prepared to state. But this I do know, that it will not grow with the soil at a less temperature than 60°; and my theory would be that if it lay any length of time in the ground with the temperature less than that it would be liable to rot.

David Woodman.—I presume that nearly every farmer present has observed corn which has been trampled into the ground by stock, and after it had lain there the entire winter sprout and grow. Now the question arises, Will corn rot when planted early?

Luther Howe, Decatur.—I once found an ear of corn at the roots of a corn hill, which seemed to have remained there all winter. I thought I would test it and see if it would germinate, and I planted a number of kernels and every one of them grew.

M. J. Gard, Volinia.—My experience is that if corn is sound and ripe you can put it in the ground any time in the spring and have it grow.

Mr. Beckwith.—Mr. Gard is probably correct, with the proviso, if the ground is dry enough; but if there are places where the water will stand for two or three days at a time, it is best not to put the seed in. With all due respect for what Mr. Hayden has said, I believe the surest way to raise corn, one year with another, is to plow and get it into the ground just as soon as you can. I always stop tending my corn before harvest, and if I did not plant until the gentleman says, it would give me a very short time for cultivation. You injure your corn by plowing it after harvest, by cutting off the roots, which often extend a distance of sixteen feet.

Mr. Durkee.—Will corn planted the 25th of May ripen as quick as corn planted the first day of May?

Mr. Hayden.—Of course we cannot lay down any rule that will apply to every season, but I believe that, taking one season with another, it is best to defer your planting until about May 20. I have noticed some seasons, in my own field, where I have planted both early and late, there was no perceptible difference in the ripening of the crop. I have seen no difference where there was three weeks' difference in the time of planting.

J. R. Hendryx.—I have been very successful in raising corn, and I plow as early as I can, let my ground lie up to the sun for a few days, and plant early.

Prof. Fairchild.—Of course the time for planting corn must vary in various parts of the State, as the season is much earlier in the southern counties than it is in the more northern ones. In the northern part of the State, in order to have it ripen, it should be planted just as early as the ground can be prepared for it.

Mr. Beckwith.—This matter of putting corn into the ground is one of great importance. I believe the ground should be plowed in the spring, just as soon as it gets into condition, after you have sowed your oats. I take great pains to have the ground nicely turned over, and then if the ground is tolerably dry, put on the roller, and then go over with the drag until it is perfectly mellow on top. After it comes up I go on with the drag, and run right over it. After it gets up a few inches I go through with the double shovel. The gentleman speaks of the large two-horse cultivator, but I can tend corn a great deal better with the double shovel and a good careful man than any other way. I have one of the large cultivators, which I have used some, but I prefer the double shovel. So far as plastering corn is concerned, almost the first work I ever did was putting plaster on corn in the State of New York. I have plastered corn generally ever since, and I don't believe that plaster ever added a single grain of corn to any man's crop. The real effects from the use of plaster is by seeding and using it on your grass crop, and then turning under to enrich your soil. Now one word about seed corn. Some gentleman says, "plant a little more than you need." Now, any one who follows my instructions will be sure to have his corn grow: Pick your seed corn early in the fall, carry it into your house, and put it up over the kitchen, or some place where it will not be affected by frost, and there will be no complaint about poor seed corn.

Mr. Curry.—As Mr. Beckwith has said, seed corn placed in a warm room where it will not be subject to frost, will invariably grow. In Kentucky, Tennessee, and Alabama they never have any trouble in having their seed corn grow, and the simple explanation is that the corn gets thoroughly ripe and dry, and the germ is not affected by the frost. In 1873 my brother and I put a portion of our seed corn over the kitchen stove, and a portion we took from the crib. That which we carried into the house all grew, while that we took from the crib refused to grow, and we were at an expense of about $25, when two hours' work might have saved all this expense.

Mr. Curry.—In Northern Indiana the farmers invariably harrow their corn before it comes up. They claim that the crop is nearly half tended by this harrowing.

Mr. Beckwith.—I want my ground perfectly level before I plant. After I plant I wait until the weeds begin to start, when I put on the harrow to kill them. But as regards the crop being half tended I don't believe in that, for it takes more than one or two draggings to half tend a piece of corn.

Mr. Morton.—The subject of deep or shallow culture has not been broached upon.

Mr. Hayden.—I am always in favor of deep culture in the early stages of the corn crop. What I mean by that is deep plowing and deep cultivation. But when deep culture would interfere too much with the roots, say after harvest, the cultivation should be upon the surface.

CUT-WORMS.

Mr. Hampton.—I would like to ask if there is any objection to plowing corn ground in the fall, especially clay soils where the cut-worms are troublesome? Would not fall plowing have a tendency to kill the worms?

Prof. Cook.—I would like to ask Mr. Beckwith if he is troubled with cut-worms?

Mr. Beckwith.—Yes, sir.

Prof. Cook.—Do you think spring plowing is best where cut-worms trouble?

Mr. Beckwith.—I have seen a great many experiments tried, and I most always let somebody else try them. There are two points which I have now in mind. I passed by George W. Jones' place one day in the fall, and he said he expected to kill the worms so they would not affect his corn crop. I told him if he had any other business he had better go about it, for it would have no effect on the worms. I had no chance of knowing anything more about it until the next fall, when I met him, and he said he wished he had taken my advice, for the grubs ate the corn as bad again on the ground he plowed in the fall as where he plowed in the spring. I have seen these worms when you first commence plowing in the spring, on a warm day, crawling around, and during the night there would come a hard frost, and these worms would be frozen stiff. But when they thawed out they were just as lively as ever. Last winter Mr. Jewell dug down almost three feet before he found any of these grubs. I know that freezing them in the ground does not affect them.

Prof. Cook.—I do not think that a majority of the farmers of this State, of New York, or of the north generally, will sustain Mr. Beckwith's opinion in reference to fall plowing, but he is right in thinking that the cut-worms cannot be frozen to death. I have exposed cut-worms to a temperature of thirty degrees below zero, and then, after taking them into my study, in a short time they were lively as ever. As I have already said in my lecture, if you will plow in the fall, harrow frequently, so as to give the robins and blackbirds a chance to pick up these worms, and then harrow early in the spring in order to let them repeat the work, I believe you will be practicing the most efficient mode of warfare against these pests.

Mr. Beckwith.—There may be something in this bird matter; but it must be borne in mind that there are millions of these cut-worms. We have been very much troubled in our part of the country, and I don't believe one man in ten believes fall plowing has any effect in lessening the number of worms. Now, in regard to fall plowing, I believe freezing and thawing all winter has a tendency to injure the soil, especially the lighter and sandy soils.

Prof. Cook.—Late fall plowing would have no effect, because the birds would all be gone. This last fall, where a man was plowing, I scared up a flock of blackbirds that was following him, and I found a number of white grubs in going a distance of three or four rods. The birds were picking up these worms.

Mr. Beckwith.—If the gentleman will examine closely next spring, when the ground first settles, he will find these worms crawling all over the surface of the ground, in good condition to be picked up by the birds. The best thing I ever did to beat these cut-worms was to turn in my hogs. I had a piece of about 20

acres on which I wintered about 100 hogs. In the spring of the year, when the ground thawed out, I noticed the hogs seemed very busy running about, picking up something in the stubble, and going down into the lot where they were, I found they were picking up the worms. As a result, my corn crop was the only one which escaped damage in the vicinity.

Mr. Powers.—I would like to ask whether worms which were in the ground last year will be there next season?

Mr. Beckwith.—My experience is this: The first season after they show themselves they usually eat up some of your crop; the next season, if they come thickly, they generally eat it all up, and sometimes they appear the third year. My advice is, that if cut-worms get into your meadows to either give them over to the hogs, or else plow them up and plant to corn.

Prof. Cook.—It seems to me from what I have heard these gentlemen say that they have mistaken the white grub for cut-worms.

Mr. Beckwith.—I know something about the white grub, and I mean cut-worms. I don't think salt will have any effect on the cut-worm, but a neighbor of mine was troubled terribly with the white grub, and he mixed a quantity of salt and plaster and went to putting it on his corn, and he got about two-thirds of the work done when there came on a rain. Then he waited two or three days and then went on and put salt on the rest. The plants on which the mixture was administered before it rained were not affected, but where it remained on the plants they were killed. The worm stopped eating the corn.

Mr. Durkee.—I think there must be some mix-up about these worms. My experience is that when you plow in the spring you don't see them crawling around on the ground, and you can't see hardly any of them. But after a time, along in May, when your corn is about ready to work, you will notice some of the spears cut off, and then by digging down in the hill you will find worms of all sizes. Now, is it true that these worms winter over?

Prof. Cook.—I can state positively, with slight exceptions, that the eggs are laid in the summer and hatch out and live over until the next year. They do but little damage the first season after they are hatched out, but live on the roots of grass and then come up in the spring.

Mr. Beckwith.—You are mistaken about these cut-worms coming up in the spring, or at least what I claim are cut-worms and see running about in the spring. These small ones don't appear until May, are the progeny of the larger ones, and I am confident are hatched out in the spring.

Mr. Rice.—I wish to give my experience on a field of corn. The weather was warm on Christmas, and I went on and plowed about an acre. The weather then changed and the ground was frozen. The ground was then covered with snow until some time in March, when the snow went off, and I went on and plowed another day. The weather again changed, the ground was frozen again, and I did not plow any more until May, when I went on and finished my plowing. The corn on the piece I plowed on Christmas day looked much thriftier all through the season, and was much the best at harvest time. Where I plowed in March it was better than where I plowed in May.

Mr. Morton.—I would like to ask the gentleman whether his soil was sand or clay?

Mr. Rice.—Sandy soil with clay subsoil.

FRIDAY EVENING.

The closing session of the Institute was opened by Dr. Bartholomew, who gave the following address on

FRUIT CULTURE.

What little I have heard in this Institute has been in relation to successes, and I propose to talk of some things wherein I have failed. I will begin with cranberry culture. I cleared off an acre which scientific men said was just the place for cranberries. I set it well with plants, and everything looked promising. About the 1st of March there came on a freshet, and I thought I would walk down and see how my crop came on. I found the plants sticking in the ice about two feet from the ground, with their roots stretching downward trying to touch the earth. That was my last attempt to raise a cranberry crop.

I was one of the first men in Berrien county who went into the culture of small fruits, and I first cultivated about two acres of black raspberries. I got an abundant yield of berries. I could pick 30 quarts in a day, carry them to market, and get $2.50 for them. I could have taken my cradle at the same time and earned $3 per day. I have tried two or three varieties of blackberries, and got a most abundant yield. I have raised the Lawton where I could pick 13 quarts without moving out of my tracks, but the raising, picking, and getting them to market took off all the profits, and they, too, proved a failure pecuniarily.

Then I cultivated two acres of currants, and did it so successfully that when I took them to market everybody said, "Did you ever see such cherry currants?" but the profit was what troubled me. I think I shipped about the first strawberries to Chicago from Berrien. I cultivated two acres of this delicious fruit, and it grew large and fine. After picking, and paying the freight down the river and then over to Chicago, I sold them for about eight cents a quart, and that proved a failure. If a man has a small piece of ground, not large enough to raise other crops, then he may succeed with small fruits; but so far as my observation goes, wherever a farmer has gone into the business it has proved a failure.

In the cultivation of fruit your first experience is with the nurserymen; and as far as my experience goes you cannot always depend on just what a nurseryman tells you, for he most always has just the varieties you want.

When I first went into the fruit business, I set four acres to apples and peaches, the apples by themselves and the peaches by themselves. The next spring I went to the nursery in Niles and got apple trees enough to set five acres. They were nice, smooth trees to look at. In about two months I noticed one tipped over, and on examination I found it broke easily, and the inside was like cork. I then went over the five acres and did not find a single sound tree. I then made a list of the varieties I wanted to set 16 acres. I wanted Baldwins n particular. So I sent to Kalamazoo, where I had no trouble in procuring hem. They came all labeled, each variety by itself. Besides the two acres of aldwins, which turned out pretty well, the rest, when they came to bearing, were all Russets except seven.

This much of my experience I relate to show you that it won't always do to depend on what nurserymen tell you.

The peach was originally the bitter almond, but from cultivation we have

brought it to its present perfection. When the peach can be propagated from the pit some varieties will not support the original kind. Most of the early varieties will produce nearly the same. For instance, if you plant the pit of the Crawford's Early it will reproduce Crawford's Early, or something very similar to it, provided that tree has been away from other trees; but if it stands in an orchard with other trees the buds become impregnated with the pollen of other varieties.

In planting peach trees, set them out in the spring. Never set a tree of over two summers' growth. The varieties to set depend on what a man wants,—whether his own wants are to be supplied, or whether he is going to raise for the market. The location in this vicinity must be on the most elevated land; and when you can get high elevated land you can raise peaches just as well here as you can at St. Joseph, or anywhere on the lake shore. [A voice.—Yes, better.] Yes,—better. I have a place in Keeler so elevated that I can see Lake Michigan when the sun comes up in the east. I had peaches there last summer. I had grubbed up the old trees, and had just started a new orchard last spring; but I left two trees, and they bore peaches, but the curculio destroyed them with the exception of a single peach, and that was a very fine one. This was the only crop raised in the town with the exception of where a limb had been buried under the snow in some orchard.

You want a strong soil for peaches. A good sandy soil does very well, but a clay soil is a little better. On the latter your fruit is finer and the trees last longer. As to distance, I would say 24 feet apart. You will get more baskets to carry to market, and the peaches will be larger and finer colored than if your trees were closer. Don't set peach-trees and apple-trees together. Set your peach-trees entirely by themselves. If your soil is strong, 24 feet is near. Set your apple-trees by themselves, and never nearer than 33 feet. If a man raises peaches for market he wants about five varieties. For apples I would only have four varieties; if I were going to plant an orchard of 40 acres I would have them about in this proportion: One Red Astrachan, two Maiden Blushes, four Greenings, and eight Baldwins. So far as merit is concerned, the latter has no standing with the other varieties mentioned, but the people will buy anything that is red. It will produce more bushels to the acre than any other apple I know of. The stock of the Baldwin is not hardy, and if you go through the orchards of the country you will find them more or less affected, and the big limbs beginning to break off just as they are worth from $10 to $15 apiece. I take the Northern Spy because it is a hardy tree. It always grows perpendicular, and throws its roots out in every direction. Then I put my Baldwin graft upon top of this body where I want to start the tree. In this way you get a tree that won't blow over, and is less liable to winter-kill. The idea of setting a Baldwin tree a little leaning toward the southwest is about as sensible as to stand a child partly on his head that you want perfectly erect. You want a tree to stand perfectly erect, for that is the natural way, and no art can improve on nature. But, if your orchard is young, after rainfalls and heavy winds you go through your orchard and straighten up the leaning trees.

Now about the preparation of the soil. The best apples I have ever seen grown were on high ground; soil, clay loam, with a clay subsoil.

Particularly do Greenings do better under such circumstances. I have noticed all through Van Buren county, where I have been for the past two or three years, that on the sandy openings the orchards are not doing as well as they are on the heavier soils and in the timbered lands. I am not able

to tell you about the prairies, for I have not seen one for a number of years; But I know that in the timbered land we get finer fruit and more of it than they do upon the lighter soils.

After you set your peach-trees plant it to corn the first year; plant it to corn the second year, and plant it to corn the third year,—in fact, plant it to corn until the trees starve out everything else. Corn will take the strength of ground less than any other cereal. If you leave the stalks upon the ground they will keep the snow from blowing off. As regards apples, there are other varieties which are far better than the Baldwin, but this variety beats everything as far as yield is concerned, and they sell readily in the market.

DISCUSSION.

Mr. Beckwith.—How about the Canada Red?

Dr. Bartholomew.—I am of the opinion that unless you have just the right locality the Canada Red don't pay. As a general thing, when they bear thickly they have little, scabby, black spots upon them; and when you come to sell them you can get only from 25 to 40 cents per barrel more than you can for Baldwins.

A voice.—What about the Northern Spy?

Mr. Bartholomew.—They are a good apple, but not prolific bearers; and I have seen Northern Spy trees 24 years old that had their first crop. I have two acres of Northern Spies, and of course I don't want any more. I have seen Northern Spy grafts put into a large tree, and it was 13 years before it bore, and then it had two apples.

The Spitzenberg does pretty well on high clay ground, grafted into other stocks. The Rambo is a very good apple, and will bear anywhere.

Prof. Cook.—Have you tried the Rubicon?

Dr. Bartholomew.—I have not tried it myself, but there are a few in the neighborhood. It is a beautiful apple.

J. R. Hendryx.—How about setting fruit trees in wheat stubble?

Dr. Bartholomew.—I don't believe in setting trees in wheat stubble or any other stubble save corn. I have noticed trees in corn grow twice as fast as in any other crop.

Mr. Beckwith.—Do you ever mulch?

Dr. Bartholomew.—Sometimes I have. It depends upon the power of the soil to hold moisture. Trees need as much cultivation as a crop of corn. The peaches I would recommend are the Foster, Hale's Early, Mountain Rose, and the Crawford's Early and Late. I think a great deal of the latter variety, both the early and late. I am not, myself, going to set any other varieties but the four I have mentioned.

Prof. Fairchild.—Is protection from western winds desirable in peach culture on high places?

Dr. Bartholomew.—I don't believe it is. If you have a boy, the more you expose him to the weather and winds the stronger he will be. I am not a very feeble man, and I never wore an overcoat until last winter. I generally wear ladies' cloth for garments, and I never carry a lantern nor an umbrella. I have practiced medicine a great many years, as you all know. If a tree is shaken by the wind it takes deeper root and grows stronger and healthier.

Dr. N. D. Thomas then read the following essay on

AIDS AND INDUCEMENTS TO BETTER FARMING.

By the cultivation of the soil the farmer is enabled to supply the two most important articles in the catalogue of civilized human wants, namely, its food and raiment. The great purpose, then, which should animate and inspire the farmer should consist in the determination to grow these indispensable articles of utility of a very superior quality, and at the same time avoid diminishing the capacity of the soil for continued production.

How we shall bring our farms up to their greatest capacity for production and maintain them there is a question of great present moment to the farmer. It is not a theme for speculation only, but it has become a matter of great importance. The cost of growing our crops under our present mode of culture and the net proceeds approximate so nearly to the same sum, that a radical change which shall result in giving a larger margin of profits is a necessity that has become imperative.

If it should follow as a result of an improved system of culture that the farmer shall receive an increased remuneration for his labor and also a larger interest upon his capital invested, he will thus have added very materially to the value of his real estate by having made it more desirable as a paying investment. It furnishes a class of securities greatly preferred by those seeking permanent investment, because it is less hazardous. From its imperishable nature it inspires an amount of confidence which no other class can possibly confer. Then, if we can by the adoption and practice of any judicious method, cause our farms to yield us a still better interest upon an increased valuation, it would furnish the strongest inducements to inaugurate the system of culture furnishing the strongest proofs of its ability to meet so desirable an indication.

Any system of farming, then, which does not contemplate as one of its principal objects the maintainance of fertility and productiveness, we must of necessity denominate a failure; and any system which does answer the just requirements of the present, will still much less those of the future. It should constitute one of our chief aims to adopt and practice the system of culture which shall answer not only for the present, but for all time.

In order to make our ideas more plain and more easily understood, we propose to give the sources of plant food and the scientific names by which they are designated, and the proportions of each. All do understand, of course, that these sources consist of the earth and the atmosphere. The atmospheric source is necessarily gaseous in its nature, and is termed the organic, and constitutes the stem and leaf-producing element. That which the earth produces is of a a mineral nature, and is termed the inorganic. When a plant is consumed by fire this combustion resolves it back into its original elements. That passing off into the atmosphere in the form of gas is the organic, and that which is left, or its ashes, constitutes the inorganic. The term by which these last are usually designated are the ash constituents. These two elements, when considered together, would be represented by 100 parts. Of this number the atmosphere furnishes from 95 to 98 per cent, and the earth the other 2 or 5 per cent. When a soil is constituted naturally very productive it is found to contain a large amount of this organic matter, which is dissolved by the rain-water, and which is taken up by the roots of plants, while the leaves, which are their lungs, absorb it directly from the atmosphere.

In these inorganic or ash constituents consists the basis of the capital which we possess in our farms. They bear a similar relation to the organic plant-food

that our gold and silver coin does to our greenbacks. This paper money would be comparatively worthless without this coin basis, nor would this organic plant-food be of any available utility in the absence of this mineral basis. We can also inflate our crops upon the same principle that we can our greenback currency. This is done when we furnish to the soil an excess of this organic matter which will develop the organs of plants beyond all proportion to their powers of eliminating a corresponding proportion of the ash constituents, or this gold basis of plant-food from the soil.

We shall experience great difficulty in supplying the loss of these ash constituents occasioned by selling our crops of grain from the farm, because our system of farming has heretofore contemplated no effectual measures looking to their preservation, nor do we possess the required facilities for furnishing an adequate supply whilst practicing our present system. It has and does still principally consist in this simple routine of plowing, sowing, and reaping. Does it require no higher qualifications than what will suffice to perform creditably this labor to constitute any man a first-class farmer? We must say that we have learned to appreciate its just requirements more highly than this. These very moderate qualifications remind us of those possessed by the pioneer schoolmaster of a half century ago, which could be expressed and spelled by the three Rs. Does our average farming present no higher claim for progress than this unsavory comparison would show? We have certainly tried to take a more flattering view of its present condition, but aside from a better adaptation and a vastly greater number of improved labor-saving machinery and implements, admitting of a more thorough and extended culture, cannot see any very material improvement in any other respect. But there are some mitigating circumstances which would tend to relieve somewhat the weight of odium which this condition of progress would seem to indicate. This country has only been under cultivation during a comparatively short period. At its commencement the soil was new and rich in all of those elements of plant-food, and all that was then really necessarily required to raise large crops of grain was this routine. But its long practice has developed a species of conservatism in the habits and practices of the farmer which has caused him to adhere to them long after he has skimmed the cream from his soil. We are now just commencing to realize that our system of culture consists in stirring up the blue skimmed milk. So long as we were able to raise large crops, the necessity for inquiring whether this condition would probably always continue was not immediately pressing; but when our present crops, grown on the same soils, in favorable seasons scarcely come up to the general average of years ago, and in unfavorable ones not more than half so much, then we are ready and willing to stop and inquire how this undesirable condition could be remedied. It is certainly a very proper time to do so, inasmuch as we did not earlier. But it is much on the same principle that it is better late than not at all.

It might be of interest to inquire if, during all of these years, we have been living from the capital stock contained in our farms, to the extent, at least, of their ash constituents used, how much less are they worth to-day for purposes of agriculture than when we commenced? Or, rather, how much more would they be worth now, with all of their present external advantages, supposing that we could, by some sleight-of-hand performance, restore them back to their original condition of fertility? It is quite probable that science is competent to solve this query, or at least make an approach to it. We would respectfully

suggest the manner by which its present capabilities could probably be relatively ascertained:

There is, perhaps, on every farm, some portion of it which has never yet been desecrated by the plow. These will be found existing along the lines of our fences or roadsides, which would represent the original condition of the soil. We could then dig up a section of this virgin soil to a specified depth, and in the same manner obtain a portion which had been cultivated. Then, by constituting this uncultivated soil as the representative of its par value, and by subjecting each to a separate chemical analysis and comparing results, we should probably be able to ascertain how much it had lost in its capabilities, or how much below par the condition of this cultivated portion would disclose. Is it not reasonable to suppose that some such method will be practiced, by which any one who may wish to assume the proprietorship of some real estate cropped under our present system for some indefinite period, may have a more certain guide in fixing values?

There are no doubt a class of light soils which present a condition of exhaustion resulting from a deficiency of organic matter which it lacks for the proper development of the organisms of plants, and which when again supplied will grow good crops. This will explain the beneficial effects of plowing under a crop of clover, which will furnish this class of plant food more cheaply and effectively than can be obtained from any other source, and by its admirable adaptation to collect from the subsoil, by its penetrating tap roots, the ash constituents for the crop which succeeds it. But we must bear in mind that we harvest these last in this crop, and if it is sold from the farm that is the end of them so far as they concern us. We should not, therefore, accept this condition of apparent fertility as being real which follows green manuring, but should regard its action more as the effects of stimulation. We should expect that in most soils where this crop was grown for a long time for such purposes that a species of reäction would ensue as a consequence, by exhausting the soluble ash constituents of the subsoil. We cannot understand how any agent which does not furnish to the soil an excess of all the elements of plant-food which a particular crop requires, and at the same time leave the soil permanently any better. This is what the advocates of green manuring claim for clover,—in fact they regard it as the universal panacea for all the ills to which agriculture is liable. We think that this erroneous belief in its capabilities for supplying fertility to an exhausted soil has exerted a very deleterious influence, by retarding true agricultural progress, because it has superseded in their minds the necessity of using any more efficient agent as a fertilizer. But when they can be brought to comprehend that where this system of green manuring is exclusively practiced, that they will exhaust this gold basis of crop growth more rapidly than they otherwise could, that they will then be brought into a better condition to realize the absolute necessity of exercising more economy in its use and become more anxious to practice more efficient means for its preservation.

It requires no great amount of observation and discernment to note the infallible signs of failing capabilities in those soils which have been cultivated since they were redeemed from an unbroken solitude by the first pioneers. The wheat crop is the one first to feel the effects of this poverty of nature, and which requires perhaps the largest per cent of this elixir of plant life, and which constitutes it the staff of life when eaten as food. We have been a close observer of this particular crop for a number of years, and have noticed a very marked difference in its appearance when growing on those soils just mentioned and

those only but recently brought into cultivation. On the first mentioned, when it commenced to ripen the straw would present a dull, dingy appearance, and in every such instance the grain would exhibit that same pinched condition characteristic of every living thing which is required to subsist upon an insufficient amount of its appropriate food. On fresh land the straw would present a bright golden, glistening yellow, and the grain would confirm the impression that this appearance was a sure indication that the conditions for healthy plant growth were much more perfect. We probably possess no class of soil which will not ultimately present similar unfavorable conditions when we practice a like disregard of nature's requirements. We shall therefore manifest our wisdom and sagacity by taking the proper steps for anticipating this growing necessity, which is becoming every year more clamorous, and not wait until its iron clasp has enclosed us within its constricting folds.

It has been claimed by some agricultural writers,—and observation and experience would strongly corroborate this view,—that the unaided efforts of nature alone on those soils which have already parted with their stores of plant-food, —which may have been ages in accumulating,—are inadequate to produce above an average of eight or ten bushels of wheat per acre for a long period, comprising a large number of consecutive crops. On such soils to-day it is quite probable that the general average will not exceed this amount, or its equivalent in other crops. Even for this low average of production, should it be continued successively for 37 years, the computed average duration of life, we would in that time abstract from the soil of its ash constituents, or, as we will also designate them, this gold basis of plant-food, over one thousand pounds per acre; and on a hundred-acre farm, one hundred thousand pounds, computed at five per cent. When we come to retrospect the past history of this class of soils, and know that much of it has already parted with more than twice this amount within this specified time, should we not rather wonder that it should not sooner have manifested more of those indubitable signs of impaired vital forces of Nature? But notwithstanding all of this, we will even assume that the soil is practically inexhaustible, and that the laboratory of Nature is competent to sustain this low average of crop growth for all time: Are we, as farmers, prepared to accept this as our maximum of production? and shall we proclaim to the world that this is the extent of our progression? We trust that there is a more desirable future before us,—one that shall present a more flattering exhibit of our real capacities and abilities than any test applied has yet revealed. But unless we can feel an undoubted assurance that the Creator has selected the farmers of the Northwest as the chosen ones whom he has supremely blessed by furnishing them immunities and exemptions which he has denied to other people, we must realize, sooner or later, that our tenure as successful wheat-growers must come to an end, should we continue to practice the system at present pursued.

This grave question, then, confronts us: How shall we be able to supply this deficiency in the amount of pabulum required to grow larger crops? We can see nothing more effectual at present than the conversion of our crops into manure by feeding them to stock upon the farm and return this refuse back upon the soil, which will constitute an increase of farm capital which will become immediately available, and upon which we can safely base expectations of largely increased production. Should we sell nothing from them only those net products, such as horses, cattle, hogs, sheep, wool, butter, and cheese, these perhaps would not absorb to exceed ten per cent of the ash constituents of

our crops, and could we return them back to the soil without further loss we should be able to start upon another year with ninety per cent more of this farm capital than we could did we trust alone to the unaided efforts of nature. Not only would we be able to economize in the ash constituents of the soil, but could add largely to the stock of organic manure, also, which would constitute a very important item, which would obviate the necessity of growing a crop of clover exclusively for the purpose of obtaining a supply of this class of manure, but could harvest it, gain an income from it by feeding it out with our grain before it is returned back to the soil.

Should it prove true, as some have claimed, that stock-raising does not pay, then are we indeed placed between two very unpleasant dilemmas. But we can at least exercise the option of choice between them, and if we are really capable of manifesting some of those great qualities with which we are wont to invest some of our eminent men, called statesmanship, our choice would be governed more by considerations of future profits and advantages which must surely follow when we make a proper use of the surest means for attaining them, and are willing to work and wait until success rewards our perseverance and toil. But should we be deficient in them, we shall be influenced more by considerations of present inducements, and will also be lacking in that spirit of enterprise which would inspire us to undertake, the ability to plan, and skill to execute successfully any great measure which would hold out inducements of ultimate future rewards. Neither would we be willing to invest in any venture unless the gains were large, immediate, and sure.

In all of our experiments with neat stock with the view to test the profitableness of stock-raising, we have been restricted in them to our lean, scraggy, bony, native cattle,—very promising specimens, certainly, to hazard an opinion upon as to its profitableness. But we trust that indifferent farming and this class of stock have played their allotted parts in the great drama of Agriculture. When one makes its exit we hope that the other will shortly follow, because when any two objects in Nature which have heretofore sustained, and for so long a time, such intimate relationship, they should not be subjected to the cruelty of a protracted separation.

When we shall come to experiment upon a class of cattle for which we can realize two-fifths more per hundred in price in our leading markets, and which will mature a year earlier, and weigh from a quarter to a third more at a year younger, we shall be able to realize 100 per cent more for them than we could for our native cattle. These are facts which should be sufficient to change our views as to the real profitableness of this branch of husbandry, and should constitute sufficient inducements for us to enter upon the only course that presents the best prospect for reaching a satisfactory solution of the difficulties and disadvantages under which we at present labor. For we have discovered that this policy of raising crops of grain for commercial traffic, which leaves us comparatively nothing to be returned back to the soil to supply the loss that it has sustained in producing them is a ruinous one. It is impairing the resources of the country by robbing the soil of its fertility, upon which they depend, and is, in consequence, making farming much more precarious and difficult.

There is also another view of the consequences of exporting grain, which should command the serious attention and consideration of the farmers of the Northwest. The amount which we export constitutes a very small proportion of our production, but the price realized in Liverpool per bushel controls the price of that retained for the home consumption. It is quite probable that we

are not able to realize any more, if as much, did we only raise sufficient for the supply of the home demand. This excess exported has no doubt been the means of demoralizing the carrying trade because as the case now stands, that for every bushel of corn upon which a price is realized two bushels more must be sent along with it to pay the transportation upon the one. Its bulk taxes the railroads to carry it to the seaboard, consequently there is no inducement left for competition, by which the charges could be reduced. It therefore places them in a position to exact all that they dare and still leave enough to the producer barely to keep soul and body together. How long do the farmers of the great grain belt of America propose to submit to this ruinous extortion? The only really effectual remedy is to raise no grain for exportation, but consume it upon our own soil and export nothing except those net products. They therefore hold in their own hands the weapon which will effectually sever this Gordian knot which binds them to this juggernaut of monopoly, whose wheels are grinding them into the dust.

We found in our efforts at economizing plant food, and from our calculations ascertained that we should be minus only the amount which our animals absorbed, which we computed at ten per cent of the ash constituents of our crops, counting no additional loss in handling the manure. Then if the farmers of the great prairies west of us shall still persist in growing corn to sell, and so long as we can purchase it from them at something near the cost of growing it here, no doubt we would find it an object to procure enough to feed with that of our own raising, or by supplementing it by the purchase and use of a sufficient amount of chemical or commercial fertilizers to make good all of this loss.

When we come to sum up this matter, the difficulties do not look so insurmountably great as many no doubt view them. If the soil is really capable of growing ten bushels of wheat annually, or its equivalents in other crops, then if we could return this or its equivalent all back again, we would possess 100 per cent more of available farm capital, from which we could reasonably expect to raise certainly fifty per cent more in products the next year, and should this also be returned in the same manner, to be followed by a proportionable increase the next year, and so on for a number of years in succession, we should perhaps finally be able to reach a point—a maximum—beyond which it would not be in our power to attain. Should we be able to reach this point, we will find that the labor and expense necessary to keep it there will be much less in comparison to that which we found to bring it to this condition.

Instead, then of conducting our farming upon those loose principles which would convey a seeming impression, at least, that we realize that our farms are capable of furnishing sufficient sustenance for our own maintainance while we live, and that there our solicitude should end, let us, on the contrary, manifest that we are influenced by those higher motives which every farmer, we doubt not, is capable of feeling, by conducting it upon those nobler and more just principles of philanthropy which comprises not only the present, but the future wants of the human race. The present is an auspicious time to inaugurate them, when our whole country is preparing, upon the most stupendous scale ever witnessed, to celebrate in an appropriate manner the noble deeds of our ancestors. Let us, then, as the proprietors and tillers of the soil comprising this great country, appropriately signify by our works that we, too, desire to deserve the grateful remembrance of the generations of the future.

When, at length, we shall have thoroughly discussed all of those questions

immediately connected with the greatest possible development of those productive resources of which our farms are capable, and shall have reached a conclusion that shall comprehend its very great necessity, and the material advantages to be gained by the introduction of a system that will be capable of achieving such results; but before we shall have started the car of agricultural progress onward upon this ascending grade, there is still another consideration of the first importance, which we should not overlook did we aim at achieving the most perfect success. For if it be true that our present system of farming is the correct criterion by which our actual knowledge of practical agriculture is measured, then it must follow that there should previously have been made a corresponding improvement in the farmer himself. We can all understand the force of the axiom which teaches that the fountain cannot rise higher than its source. Consequently we cannot believe that agriculture will be competent to progress any faster than the agriculturist. The farmer has given ample proofs of his high appreciation of much knowledge in the professions and in the various other vocations, but thus far he has failed to realize its value and importance in his own.

We have been repeatedly asked by farmers, Why do you desire that your sons shall receive anything more than a common business education if they are only intending to become farmers? This query conveys a painful significance. It discloses the very low estimation in which the average farmer holds his calling, and the very limited amount of acquired knowledge and cultivated ability he deems is requisite to conduct successfully the most important industry of civilization. Does he really suppose that other people will voluntarily entertain a higher appreciation of him and his vocation than he does himself? We have seen no phase of human nature that would warrant the indulgence of any such expectations, but believe, on the contrary, that it is not impelled by any such disinterested considerations. Nor does it in its mad pursuit of wealth and power hesitate to reach for and grasp them above the prostrate forms of those who block its way.

While this prevalent low standard of educational acquirements is considered sufficient for all the needs of the farmer, is it wonderful or strange that the young men who have grown up on the farm, and who may have harbored a dawning suspicion that they possessed faculties and nurtured aspirations for which they could not entertain a hope that they should ever be able to develop their higher expression or enjoy their more rational gratification by remaining upon the farm? The arch of their prospective horizons has been spanned by no rainbow of promise which they believed would relieve the monotony of a life which they regarded must otherwise be devoted to toil and drudgery. They have received no sure intimations that the curtain could be withdrawn which obstructed their view of a hidden world which the book of nature could reveal, captivate, and charm by its strange, beautiful, and mysterious revelations, which could have changed by giving the desired direction to their thoughts and moulded differently their destinies by substituting new hopes and wiser aspirations. But in the absence of all such counteracting tendencies and encouragements to pursue a vocation in which culture and superior knowledge has been regarded as being out of place, they have thus been constrained to search in other fields more promising, in which they hoped to reap the golden harvest of their youthful dreams. They expect to accomplish this by joining the ranks of the already overcrowded professions, or by turning their faces toward our large cities, flushed with the glow of health and buoyant with young hopes and high

expectations. But when they have applied for the places which they aspired to fill, would find the entrance thronged by a hungry, voracious crowd who had already preceded them, but of whom only the most determined and persevering could gain a place. The weaker ones are thus turned back disheartened and discouraged, and thrown upon a society of whose wiles they were ignorant, and which furnished upon every hand its dens of infamy and its abodes of vice and crime. Into these moral whirlpools many would be unwarily drawn, fall, and become social wrecks ever after, floating as debris upon the ocean of life.

Could we be so fortunate as to be able to impress upon the minds of this class of young men the fact that enlightened agriculture is really capable of furnishing all of those higher and more solid rational, intellectual enjoyments, and secure for them a larger measure of that true, manly independence that can be found in any other walk of life, we perhaps could then induce more of them to remain cultivators of the soil. We should then not only benefit society at large, but would be able, with their enlightened aid, to furnish more volume to the impulse of agricultural development. Were they ambitious of fame and distinction? Then there is no other field in which their competitors will be so few, because in no other class so numerous are there a less number who are the possessors of superior educational acquirements. This will contribute to make their success more certain. These intellectual enjoyments are greatly enhanced, and the manifestations of the powers of the mind increased, when allied to health and strength, which is more surely maintained by the exercise and labor indispensable to the proper cultivation of the soil.

For so numerous a class, the farmers of this country have heretofore played comparatively a very insignificant part in the direction of its affairs. But the day, we trust, is not far distant, when they will become more competent to wield the influence in it, and exert the power, to which their numerical strength and their just rights shall entitle them. Then those who are the real exponents of agricultural progress will become fitted to stand in its front ranks. There is no other business of life in which ambition has played a less conspicuous part than in farming, nor in no other in which the impetus this aspiring sentiment could give would it become more beneficial. In the past, muscle has played the most important part in farming; but in the years to come another element will become equally as necessary and indispensable, called brain, which will require for its greatest efficiency just as diligent a course of training for its proper development as the muscular system. What agriculture, then, really requires, for its better development is more of these trained and educated young farmers, who will be capable of becoming more efficient in this respect, and who will bring to its aid a brighter glow of enthusiasm and a more active ambition,—attributes indispensable to the greatest success in any business.

We have an institution in our own State, munificently endowed by our General Government, designed expressly for this class of young men. Being the first of its class established in this country, it has bravely maintained its position in still remaining at their head. We, as the farmers of Michigan, should feel proud of our Agricultural College, but thus far it has received rather a reluctant and tardy appreciation at their hands. But we are glad to be able to say that it is steadily gaining in the confidences of the farmers. And when its real capabilities for advancing their true interests are better understood that then they will be better prepared to value it more as it truly deserves. The course of instruction marked out for its students to pursue, if diligently studied, will not only constitute them well educated, but has a special reference to fitting

them for a more scientific and intelligent practice of the noble vocation in the interest of which it was instituted.

The farmer has so long been the subject of opprobrious epithets and invidious comparisons that it would not be wonderful should he at times come to look upon himself almost as a degraded being, and to view his calling with feelings of aversion, as being its source. If there should be any who may have thus regarded themselves, but who have been so much mistaken as to the real or imaginary source of their sensations, we would regret that there should be a cultivator of the soil capable of so great a weakness in permitting an idea so unworthy to obtrude and poison his mind, and the rank treason expressed even in thought against the respectability of the nurturing bosom of Dame Nature, our common mother; and although we may be unworthy sons, yet we should feel proud that we are the children of so noble a parent, whom we should learn to serve better, and manifest our love and veneration by heeding her gentlest admonitions and executing her slightest commands. Do we not merit to occupy a higher place in her regards than those people who inhabit the cities? for is not the broad and beautiful expanse of the country which we inhabit her domain?—its plains and its forests, its mountains and its valleys her own most noble architecture, and the city that of man, a mere creature of her own creation? These two architects, Nature and Art, are said to travel hand in hand together, but we will add that Nature always leads. Of these two diverse conditions of society, in which is the vital force the strongest and most vigorous? Statisticians who have investigated in this direction have discovered that those who are born in the city and have always lived there, with this condition continued to the third generation, that then this vital force becomes too feeble to be farther perpetuated; and that it is only through the infusion of this more vigorous and healthy blood constantly flowing in from the country that their present average stamina is maintained.

Should we search the annals of history for the purpose of learning where its truly great ones had their origin, we would find that nine-tenths of them came from the ranks of the common people and from their rural abodes. It was from amid the sublimity of Nature's grand scenery, but from homes of privation and lives of toil, that many started upon their successful careers. They graduated from this high-school of Nature, where they learned the noble art of developing their thews and sinews, and of cultivating courage and self-reliance. It was here that they developed that tireless energy and unconquerable will which was satisfied with nothing short of victory or death. It was in this rugged school where they acquired their physical strength and their great powers of endurance which fitted them to fight successfully the battle of life, win and secure undying fame. When Nature creates a giant mind for some great and wise purpose, she also moulds a structure which is to carry it to carry it to correspond. There should exist a happy union of brawn and brain. This incomprehensible battery which generates God-like intelligence should experience no interruptions in its circuit to produce those profoundest intellectual manifestations.

These admirable physical developments are found no where else in such perfection as among our rural people. Possessing, as one of the noble fruits of toil, such superior advantages for the culture and development of our physical manhood, what other important essential, then, is still lacking? The hand of what great magician is yet wanting, whose magic finishing touches could transform us not only into nobler men, better farmers, more capable and useful citizens, but which would also permit us to march to the front, and take our places

in the world as the peers of its wisest and best? Education! To cultivate more and better our own immortal natures, and kindle within them that sacred, intellectual, Promethean fire, whose glow will illumine the human features with its electric light which comes of swift intelligence and expanded thought, and crown with this royal diadem the brow moistened by the perspiration of honest toil, and mould into a nearer semblance to that Supreme Intelligence who is the fountain and source of all knowledge and wisdom.

Dr. Thomas was followed by Prof. Geo. T. Fairchild, who gave his lecture on Education. (See lectures and addresses following this record of the Institutes.)

J. R. Hendryx made the following remarks, which were replied to by Dr. Kedzie:

In behalf of the people of Decatur and the farmers of Van Buren, I thank Dr. Kedzie and the other distinguished professors from the Agricultural College, for the rich entertainment which they have given us during the past two days. Great anxiety has been felt by many members of this community for the success of this institute, and I think that all will agree that their highest anticipations for good have been realized. While I am aware that some will go away without being practically benefited because they will not make use of the valuable information they have heard, still a majority will put in practice these experiences and teachings, which have not only benefited them socially, but will also repay them in dollars and cents. I, for one, feel greatly remunerated for all the time and trouble I have taken in arranging for this institute; and I move a vote of thanks to the professors of the Agricultural College who have contributed so largely to the success of this Institute.

The vote was unanimous, and in response Dr. Kedzie said:

In behalf of the professors of the College and myself, we consider the thanks due from us, and ought not to come from the people of Van Buren county who have so generously received us, for we all feel richly repaid in coming to Decatur.

ROCHESTER INSTITUTE.

The Institute at Rochester followed immediately the one at Armada, commencing on the evening of January 13, and was attended by the same representatives of the Agricultural College, who on arriving by the train from Detroit, a few minutes after 7 P. M., found the commodious hall in which the sessions of this Institute were held, beautifully decorated and densely filled. Hon. Lysander Woodward ably presided, and Mr. T. S. Sprague was chosen as secretary. A quartette choir was in attendance during both the day and evening sessions, and contributed much to enliven the meetings by their excellent music. Hon. J. Webster Childs, who was present at this Institute and took part in the proceedings, made the following

OPENING ADDRESS.

Ladies and Gentlemen:—A Farmers' Institute is a novelty, but we hope none of our friends not immediately associated with us in occupation will think we are "putting on airs" by designating our gathering by so high-sounding a title, and one that seems appropriate only to a meeting for educational purposes: for

the object of our coming together is nothing less than to educate ourselves in our calling, and thus become better and more successful farmers by our labors being more intelligently directed.

The State Board of Agriculture, earnestly desiring to further the interests of the farm and of agricultural education, and believing that those interests might be very much promoted by the practical farmers of our State and the faculty of our Agricultural College meeting together for a comparison of views and experience, have accordingly invited the professors of the college and the farmers of our State to join with them in holding a series of Farmers' Institutes; for experience has long since taught us that in no way can knowledge upon any given subject be more surely obtained than by the association of mind with mind,—by discussion, calling forth the results of the reflection and experience of the individual for the information of the many,—and thus, by thoughts expressed, other minds are stimulated, new thoughts awakened, reflection, investigation, and experimenting encouraged, and so a more thorough knowledge of the given subject is obtained, and success in any given undertaking rendered more sure.

And as a result of these facts, there is scarcely a pursuit, occupation, or profession known to civilized society, except ours, in which those connected therewith have not, for a long time past, shown their sagacity and wisdom, and largely developed, built up, and promoted those interests by conventions, board meetings, institutes, and associations.

While this has been going on, if those engaged in other pursuits have outstripped us in many respects, they winning greater success and we falling behind, has not the fault been our own?

Until very recently the farmers of our country have been slow to move in anything like a united effort in this direction. To be sure we have for a considerable number of years past, had our State, county, and district fairs,—the importance of which, when well conducted, we would not undervalue,—where we have had an opportunity to exhibit and compare the results of our labors, but little or none to discuss the processes by which those results were obtained. Here and there, also, in different parts of our country, farmers' clubs have held their weekly or monthly meetings for the discussion of subjects of vital importance to the interests of the farm and the farmer's home, and the communities where these have been located have reaped rich benefits therefrom. But the number of such clubs has been very small, and their discussions, except in here and there an instance, have not been published beyond the limits of their own neighborhoods. And while agriculture is to a great extent the source of our nation's real wealth, and success therein the foundation of the State and nation's financial prosperity, and while nearly one-half of the adult population of our country are engaged therein, the portion of the public press devoted to this interest has been very limited; and those papers that have attempted to maintain the character of agricultural journals have, as a class, been rather poorly sustained. While we would most gladly see every farmer's family supplied with one or more good newspapers devoted to general reading, we would earnestly urge the sustaining and building up of those papers that are devoted exclusively to the farm, the orchard, and the garden, so that from a liberal patronage they may be able to call to their aid the best talent and the widest experience, thus enabling them not only to take a higher rank among the periodicals of the day, but also to become a greater auxiliary to those for whom they are particularly designed.

We would also urge farmers, either as individuals or by united efforts, to sur-

round themselves with agricultural libraries and scientific works, that by their researches, and truths developed, will aid us in achieving success in our laborious pursuits.

Brother farmers, we may congratulate ourselves that to some extent, at least, a new era is dawning upon the agricultural interests of our country. From one end of our land to the other the minds of our farmers are waking up to the necessity of a more thorough knowledge of the facts and the scientific truths that underlie our success, and of how we can best meet and overcome the many obstacles we find in our way; how to bring our soil most readily and surely to a higher state of cultivation, that we may reap more abundant harvests; what fertilizers we shall use, and how to apply them; what crops can be most successfully grown in given localities, and how to produce them in their highest perfection with the least labor; and what stock to grow, and how to manage the same; and also are earnestly inquiring which among the numerous birds and the myriads of insects are the friends, and which the enemies, of the orchard and the field, and how to encourage and protect the one class, and successfully overcome and destroy the other.

In this connection, with great pleasure we refer, as an illustration of the advantages resulting from investigation and discussion, to the Michigan State Pomological Society, by whose meetings and publications so much information of vast importance to the fruit-grower has been disseminated, and which has tended to develop that great interest in our State until Michigan stands to-day in the very front rank of fruit-growing States, having won the highest prize in the great national pomological exhibition at Chicago last fall; and we most earnestly wish that their annually published report could be placed in the hands of every fruit-grower in our State.

The object of this, as of other farmers' Institutes that are being held in different parts of our State the present month, is to investigate the various important subjects to which we have referred, as well as the no less important one of how we shall most successfully beautify our rural homes, and throw around them more evidence of culture and refinement.

Among the many signs of the times from which we predict the advancement of our farmers in a knowledge of their occupation, is the fact that not only are they everywhere calling on each other for the results of their practical experience and investigations, but no longer do we hear the intelligent tiller of the soil scouting the idea of *"book-farming,"* or the necessity of the farmer having a knowledge of science; but, on the other hand, we are turning earnestly to our colleges, planted in the interests of agricultural education, in the front rank of which we proudly behold that of our own State, and saying to them, Give us the results of your scientific researches, and long and carefully conducted experiments, and show us on your finely laid-out fields and extensive gardens the highest style of improved husbandry,—and we are not calling in vain.

We are happy to see so large a gathering of the intelligent farmers and their families of Oakland county and vicinity, and also to be able to announce that the president and several of the professors of the Agricultural College are present. You will therefore please proceed to organize the Institute by choosing a chairman and secretary.

The remainder of the first evening session was occupied by President T. C. Abbot, who gave his lecture on "Industrial Education," substantially as given with other lectures following this record of the Institutes.

FRIDAY FORENOON.

The forenoon session was opened by Mr. Garfield, who read Prof. Beal's lecture on "Grasses and Forage Plants," for which we must again refer our readers to the lectures as above.

Miss Annie Hall read an essay on "Home Culture," as follows:

HOME TEACHINGS.

When a farmer sows his crops or plants his orchards, he knows that certain states of weather and soil give certain effects, and so far as it is within his power, brings about them those which are beneficial and averts those which destroy. No plant, tree, or flower is more sensitive to sun, shower, or soil than is every human life to the thousand trifling things which make up its daily existence. Yet how much more attention is paid to the first than the last. Is it because in this age of mammon-worship, the value of a crop of grain outweighs the value of a human soul with its untold powers for good or ill? Or because from long habit and necessity, we give so much thought to money-getting and so little to anything else? Home is the place where a life is rooted and from whence it draws its greatest good or deepest ill. Minds are warped or developed by trifles so small we seldom see them, and while none of us can shirk the responsibility of living, nor hold lightly the influence we have upon those around us, we often unconsciously, by some word or deed, change the tenor of a whole life. We often complain of the prevalence of deceit, denounce this as an age of shams, and declare genuine men and women to be very few; and yet, when we pause to think of it, we know that, except in very rare cases, we are taught to be one thing at home and another abroad, and the only wonder is that there are any candid people in the world at all. From our earliest recollection we have been taught to lisp our "Please," and "Thanks" to strangers; have seen the best rooms, best dishes, finest clothes, and sweetest smiles given to guests, while the barest, poorest, and sourest have been made to serve for the members of home. Passing through the country at night we see large farm-houses with no light except away back in the kitchen. Those people have cosy rooms, with carpets, pictures, and perhaps a piano, but they are seldom entered except when some visitor comes; while the piano misses its mission of brightening evenings at home because there is no fire in the room where it stands.

Should some one come, the rooms will be warmed, lighted, and filled with music, laughter, and jest; but the next evening will find the family back in their kitchen again, sitting in their soiled clothing and fretting over all the worries they can think of. Living not only in the back of their house, but also in the back, dingy rooms of their natures, is it any wonder that the young girl comes in time to make the same difference in her manner that she has been taught to do in everything else? That she should keep her cross tones, hasty temper, and perhaps weak morality with the cracked dishes, broken-tined forks, and old clothes, which are considered good enough for home service, and don her bright wit, smiles, and high-toned words with her ribbons and pretty dresses? Or that the young man should go out into the world taking with him the principle that if he can dissipate and cheat without having it known, he is none the worse? We seldom teach by our example to love and do right simply because it is *right;* to avoid and hate wrong simply because it is

wrong. In discussing any proposed action, the first consideration usually is, "Will it pay?" and the second, "How will it look?" Any economy which we are obliged to practice must be carefully hidden from our neighbors as though it were a disgrace; and if a person come who is wealthier than we, every effort is put forth to give him the impression that we live in the same style that he does.

The grange has done much for farmers, and we see with joy that many of them are becoming more independent and self-asserting than ever before. Why can we not rise above the idea of trying to do just as some one has done, establish our homes and lives upon a solid basis, and striking as broad an average as we can afford, never vary from it, though a foreign prince should call upon us. How much work and nervous excitement this would save, while allowing us to extend a broad, true hospitality. Our guest would go away feeling that he had not thrown the household machinery out of order, and though an honored or dear friend, the family held best of everything in the house as well as the heart.

We would have farm-homes filled with all the beauty and comfort their owners can afford, but would have nothing purchased for display. The use of beauty is to refine; and this it cannot do except by daily contact.

We have thought that a useful lesson on the power of beauty to attract might be learned from the proprietors of saloons and theaters, who spare no pains in decorating their walls with pictures and procuring sweet music, to fascinate the eye and charm the ear. Were parents as zealous in making home, with all its influence for good, as attractive, there would be fewer wrecked lives and fortunes.

In many farmers' homes there is a scarcity of reading matter; yet no investment pays greater interest in pleasure and profit than good periodicals and books. But great care should be taken to have them of the *best*. No thinking person can doubt that much wretchedness and many crimes are but the fruit of thoughts which first gained life from the printed page. No stronger proof of this is needed than Aaron Burr gave when, an old man, looking forward to a hopeless future and backward over a blotted past, he said, "If, in my youth, I had read Voltaire less and Sterne more, I should have known the world was large enough for Hamilton and me."

It is said that Cæsar's influence over his vast armies lay in the fact that he did not stand and cry "Go!" but stood in their front and said "Come!" We are none of us Cæsars, but we each have some influence, which, though it may not be strong enough to *send*, can certainly *lead*. So let us, by daily watching and thought, bring, as far as possible, into harmony, our lives at home and abroad,—live more for those we love, and less for those we entertain,—and by so doing gain a self-respect which can not fail to help ourselves and others.

"True worth is in *being*,—not *seeming*:
In doing, each day that goes by,
Some little good—not in the dreaming
Of great things to do by-and-by;
For whatever men say in blindness,
And spite of the fancies of youth,
There's nothing so kingly as kindness,
And nothing so royal as truth."

Some very excellent and practical remarks were made in a general discussion of the topics treated of in Miss Hall's essay, but here, as at Armada, there being no short-hand reporter, we cannot give the discussion in this report.

AFTERNOON SESSION.

The afternoon session was opened by Mr. Ingersoll, who gave his lecture on "What Stock Shall we Keep." (See lectures and addresses following this record of the Institutes.)

Mr. Ingersoll was followed by Mr. John Lessiter of Orion, who read the following paper on

FEEDING STOCK.

I would wish to say a few words to my brother farmers of Oakland county in regard to better care and feeding of our stock. It is a very common thing to see, nore particularly in our neat stock, young animals that grow only from six to eight months in the year—and in some instances less. Now, this is wrong, and a loss to the breeder. We should certainly grow them twelve months in the year. I would recommend, to commence with the calves, to give them six quarts of new milk twice a day for four weeks, and then bring it gradually to the skim-milk, then scald to each calf a pint of fine middlings, and put in the milk. Feed that quantity for four months at least; besides, as soon as the calves will eat, I would give them a little early cut clover hay and a few oats. I consider oats the best feed we have for making muscle. Keep your calves tied up in the stable until they are at least two months old; and if they can be led out a few times they will rarely forget it when wanted to be led a year or more after. When four months old you can leave off the milk gradually and increase the oats with the mill feed mixed. We have now good, strong calves that can digest any good feed (except too much corn meal). Be liberal with your oats and early cut hay the following winter, and a few roots if you raise them, and when grass comes you will have yearlings that will grow, please the eye, and be worth more than their feed bill. In the latter part of September if you can have them run in a pasture field next to your corn, commence and give them corn in the stalk as soon as it is in the shock, or before if your pasture is short. Don't wait for your neighbor to commence feeding. One acre of corn will feed eight or ten head of cattle a shock a day, longer than you at first think. Now, if your cattle are intended for the butcher, after feeding them forty or sixty days, according to your pasture and the season, you will then put them in a warm stable, and if you do let them out to water put them back in one half hour; feed them at regular hours each day, with corn and oat meal, good hay, or cut stalks, and a half a bushel of roots each per day. Whenever your stables smell sour reduce your feed of meal. If you are busy taking care of your fall crops and your meal is not ready, feed dent corn in the ear; it is easier digested than the common yellow or white varieties, and with your pigs running to the manure you will sustain no loss. I have seen cattle lay on fat as fast as when fed on meal, and there is less risk in over-feeding. With such feeding steers and heifers can be made to bring when they are two years old from $50 to $60 per head. I am presuming they are from a thoroughbred short-horn sire, or of some other beef-producing breed. In conclusion, I would advocate using none but thoroughbred sires in all the stock you raise, from the improved breeds that your choice would lead you.

Mrs. Keeler of Disco read the following essay on

SOCIAL CULTURE FOR FARMERS.

Man is necessarily a social being. A solitary life, though sometimes sought by the misanthropic hermit, soon becomes intolerably wearisome even to him,

and he is glad to mingle once more with his species, though of the most humble description. The farmer and his family necessarily live a most isolated life, or neglect their business in a greater or less degree if they mingle much with their fellows. If the farms in a community be large, and the season hurrying, days may easily pass without meeting any person but the members of the family or the farm hands employed. What wonder, then, that when brought into the society of people of leisure and elegance the farmer appears awkward and ignorant, his wife old-fashioned and plain, and his children painfully bashful?

Men who till the soil for a livelihood, who grow the bread and meat and vegetables that sustain their lives, though following to my mind the noblest work that stout hands and hearts can do, have become everywhere a synonym for coarseness and ignorance, and also,—let us say it with pride,—for innocence and honesty. Though the innocence, by the elegant city swindler, may be termed greenness, and the honesty be considered a fault, yet there are others whose opinions bear more weight than his.

We have taken one long stride toward remedying these inconveniences of a farmer's life, by the organization of our grange system. There, old and young, rich and poor, mingle freely together on one common platform. There, youth may profit by the experience of the old, and age take a new lease of life from witnessing and joining in the gayety of the young. The poor may profit by the advice and counsel of those who have been successful in acquiring property, and the rich may be moved to pity, encourage, and assist their weaker brethren.

Ignorant and uninformed people need not long remain in that unfortunate condition when they mingle freely and equally with their cultivated and educated brethren and sisters of the order. If gifted with ordinary powers of perception they must,—insensibly, perhaps,—improve mentally; and, if the noble principles of our admirable organization be carried out in all their original purity and excellence, morally as well.

I see no reason why our young people should not make better, more cultivated, more honorable, and more efficient men and women,—more competent wives, more successful husbands, and more contented and law-abiding citizens, for having become associated with the order of Patrons of Husbandry. It is to these same youths and maidens that we must look for the future welfare and honor of our beloved grange. Then let us induce as many as possible to join us, and make them welcome and useful when they come. Let us strive to inculcate principles of uprightness, truth, and honor, and while educating their heads, educate also their hearts, and fit them in every possible way to fill even the most exalted positions our land can offer.

People who dwell in cities have ready access to well-filled and carefully-selected libraries, while few of the farming community can afford the luxury of owning one themselves. Books are a great aid to the development of the conversational powers, and help to keep the mind employed during many otherwise lonely hours. Evenings may be profitably spent in the perusal of an interesting volume, and the younger members of the family will find the reading, or listening to the same, a powerful incentive to remain at home, instead of wandering away in search of less innocent amusements.

I would advise every farmer or farmer's wife to take at least one good newspaper, with one or more standard magazines, and season the mixture with a liberal sprinkling of the latest publications of the most popular authors and poets. This will certainly keep the mind from retrograding, and I think will soon prove a decided benefit.

Mr. W. L. Carpenter read the following essay on

OBSTACLES TO THE ADVANCEMENT OF AGRICULTURE.

In this day of agricultural reform the great desire is to make of agriculture a science; to work by principle rather than guess; to apply skilled, educated labor, rather than unskilled, ignorant labor.

To do this it is evidently necessary to pursue the same principle that has raised other occupations to the position for which agriculture has vainly striven. Let us then find, if we can, this principle. By an examination of advanced occupations we find that though they differ much in many respects, they all agree in keeping one man confined to a small portion of work. This principle, called division of labor, is well illustrated in any large manufactory.

Observe, for instance, the manufacture of chairs: One man makes the rounds, another the seats, a third the upper portion of the legs; everything so arranged that each does only a small portion of the work, and hence is constantly going over the same ground.

The advantages of this system are obvious. Less time is required to learn a trade, for there is much less to learn; hence there is much less waste, for it is in learning a trade that the waste chiefly occurs. Great skill and great manual dexterity are acquired, for a man is constantly going over the same ground; a man finds the exact position for which he is fitted. We are not all created alike. Each has talents which peculiarly fit him for some one position, and totally unfit him for many others. By the application of this principle he may confine his entire attention to one thing, and that one thing may be, and usually is, that for which his talents fit him. Articles are uniform, for the laborer, constantly going over the same ground, learns to perform his labor exactly alike each time; hence the sale is better, market more permanent, and business more stable.

Skill is well paid for, and is at a premium of several hundred per cent; hence an incentive is furnished for the acquisition of skill, and a continuance at the same work. The pin-maker may, by continuing at his work and acquiring more skill, double, treble, or quadruple his wages, become master of his associates, foreman of the department, or superintendent of the manufactory. As an illustration of the advantages of this system, we quote from Adam Smith: "One man, working alone, can make 20 pins in a day; thus 18 men would make 360 pins. By division of labor, 18 men can make 90,000 pins in a day. Thus each man would make 5,000 pins, or 250 times as many as by the old plan."

The increased productiveness of every advanced occupation is owing to the successful application of this principle.

Wherever this principle has been applied to agriculture advancement has been made. Machinery, in which lies our chief superiority over the ancients, owes its manufacture and improvements to this principle. Cheese-making and fruit-raising, which have realized the advantages of division of labor, are the most advanced of agricultural operations. In the great mass of agricultural operations this principle is not applied. The same man plows, mows, reaps, and sows.

A man may become a skilled plowman or a skilled mower; but he can not possibly become skilled in all agricultural operations.

As the increase of wages and the advancement of position are in proportion to the skill acquired, the laborer can, at best, hope for an increase in wages of only three or four dollars per month, hence no incentive is furnished for persistent labor in this occupation, and young men leave the farm to engage in labor where industry and skill are better rewarded, and agriculture is retarded by their loss.

The question very naturally arises, if this principle has done so much for other occupations, and benefited agriculture wherever its influence has been felt, will not its increased application, keeping a laborer constantly employed at the same work, be attended with the skill, economy, and general advancement that has hitherto accompanied it? Unfortunately agriculture presents difficulties to the successful application of this principle not found in any other occupation:

1st. The climatic conditions: the succession of seasons, the changes of weather, all tend to render it impossible for the same work to be constantly pursued. A farmer can not engage in the same kind of labor in the spring and autumn. He can not reap in January, nor would he find it comfortable to cut wood in August.

2d. The peculiarities of vegetable growth, demanding a succession of plowing, harrowing, cultivating, seeding, and harvesting, present another barrier to the application of our principle.

3d. The condition of fertility demands rotation of crops, and therefore divides the farmer's attention and labor among several crops, increasing thereby the varieties of farm labor, as each crop requires certain different operations.

4th. The more capital farmers employ, the more removed are they from others by their enlarged farms, and separation in space fosters separation of interests, rendering difficult any plan of coöperation.

Besides these natural obstacles, there are obstacles arising from the faulty practices of farmers. The custom of exchanging employés every time one can be obtained at lower wages than the present one, is pernicious, so far as the application of our principle is concerned. Every farm is peculiar in the arrangement of its fields and buildings, and it is several days before the new employé is accustomed to them. Each farmer wishes his work done in a certain peculiar manner, and months elapse before his employé can suit him in these respects. Another faulty practice, is that of varying the products of the farm with the price of each commodity. Wheat, corn, or barley is alternately the staple product, according as its price predominates. To say nothing of the usual waste by changing the form of capital, the custom presents, as may be readily seen, necessities for a change of work with each change of products, and hence offers opposition to the application of our principle.

Let us see if some plan can be adopted by which some or all of these difficulties may be avoided or obviated, and division of labor promoted. A good system of drainage would obviate the difficulties on account of climatic changes, as it renders the soil dry, and nearly always in a good condition, thereby rendering necessary but little cessation of labor on account of unfavorable weather. That rotation of crops most favorable to division of labor should be chosen. Numerous farm societies and frequent meetings of farmers will develop the social element, render coöperation possible, and obviate the disadvantages from isolation of space.

When you are suited with an employé you should keep him, even at increased wages. He knows the arrangements of your farm, can manage well your team, has accustomed himself to your peculiar machinery and management. You can tell him what to do and he understands you, for he knows your peculiarities. When you get a new employé you must spend several days showing him around the farm, and for months you are annoyed by blunders which your old hand did not make. No reduction of wages less than five or six dollars per month should induce you to change employés, if economy alone be your object.

Farmers should adopt a system of farming, refrain from those expensive

changes of capital made necessary by a change of products, and thus avoid the waste of time now spent in becoming accustomed to new forms of productions. On large farms, where several hands are employed, everything should, as much as possible, be arranged for keeping one man constantly at the same labor: keep one man constantly at work with the team, and doing the same chores.

By reducing the number of crops raised, the varieties of farm labor will be proportionately reduced, and a sufficient number of crops still be left to furnish a good rotation. It will frequently be found that, owing to the peculiar soil or location, certain crops can be purchased for less than it costs to produce them, and these should be the ones sacrificed. There are in Oakland county to-day, many intelligent farmers dividing their labor and attention among eight or ten crops, two or three of which they could purchase for less than it is costing to produce them, and any five of which would give them a sufficient rotation.

Could we not, by a slight change in our present system of farming, carry much farther the principle now applied, in thrashing and sheep-shearing? One man or one set of men can be constantly employed in running the machinery for a community, another in doing their plowing. Thus let every neighborhood have a gang for doing each variety of labor, and keep one gang constantly employed at the same kind of labor. In this way skill would surely be developed, accidents done away with, and carelessness diminished. Consider the cost of teaching inexperienced men to run your machinery; compare your breakdowns and accidents with those of the skilled thrasher, and you will be willing to pay for skill. You find it more profitable to pay skilled sheep-shearers two dollars per day, than to set your inexperienced hand, whom you are paying twenty dollars a month, at the work. The principle is the same, and it is of wider application.

It would seem that by a radical change in our present system of farming division of labor can be carried much farther. Let a community of farmers unite in a company, much as capitalists now do in a manufactory, calling the value of their farm property so much stock. Let them elect one man general manager, who shall have the oversight and general management of the entire farm; another shall be superintendent of the wheat department, and he shall have for his business the raising of wheat; a third shall be superintendent of the fruit department, and he shall have the superintendence of matters connected with the production of fruit. All the departments should thus be filled, taking care to select for superintendents men well skilled in the peculiar work of their department.

Those farmers best succeed who make a specialty of some particular crop. When we hear of a great farmer's success, we naturally ask, "What is his specialty?" and are not disappointed at the answer, wheat, corn, or barley. It will frequently be found that one farmer is having good success with wheat as his specialty, while his neighbor, on the same kind of soil, is succeeding equally well by making potatoes his prominent crop, thus showing that success is owing more to the knowledge gained by close attention to some particular crop, than to any peculiarity of soil.

If farmers can thus acquire skill, and succeed in raising some particular crop by merely making it the prominent feature of a rotation, how much more would be the skill acquired and success gained by these superintendents, who could devote their entire attention to the production of one crop. By this plan every employé would find his entire labor in one department, and the larger the

farm the more numerous would be the departments, and hence the fewer kinds of labor in each.

By adopting this or some similar plan, one laborer could confine his attention to one thing; skill would be developed, and wages proportionally advanced; we would have skilled plowmen, skilled mowers, and men skilled in every branch of agriculture. An incentive for acquiring more skill would be furnished, by regulating the wages according to the degree of skill acquired. Knowledge of agriculture would be increased. Each superintendent could conquer the small portion under his control, and discovered facts would be preserved. The incentive to acquire knowledge, by making advancement to high positions dependent on that, would keep men active in bringing out new truths, and in improving themselves. Farming would thus become a business, and our farmer a business man, a man of culture, and a man of knowledge.

Perhaps one of the greatest obstacles to the advancement of farming is the tendency of young men to leave the farm and go to the city, there to engage in some other business. While the lawyer and merchant leave their business in the hands of their smartest child, the farmer is often forced to allow his dullest son to carry on the farm. In this way farming has lost what would have been its best followers, and its progress has been much retarded.

The reason is, I think, obvious, and has been already suggested. They want more of a chance for advancement. They want to reach positions of prominence, where there are men under them. They want to be boss,—and more of a boss than a farmer can be. They want the power of giving patronage. At farm labor they can at best become only farmers, and under our present system this is not the position of prominence which they seek. They secure positions on the railroad, where, by diligent labor, they hope to some time fill the position of the proud superintendent, or that of the good-natured conductor.

By the adoption of the system suggested, all these incentives would operate to keep them at farming. Diligent labor, and that alone, would increase their wages. Farm manager and department superintendent would be positions which they would proudly fill, for which they would gladly labor, and which they could secure only by labor. The adoption of this system would give us, then, as an accompanying advantage to division of labor, *freedom* from this, the greatest of all obstacles to agricultural advancement.

An essay was read by Mrs. Barwise in which she urged the necessity of women being competent to transact business. Admitting the importance of home duties and aware of the large proportion of their time which most women must devote to them she would not allow them to exclude the possibility of mental culture. She claimed that sad results frequently followed from women being incompetent to transact ordinary business. Every woman should be able to draw a note, write a contract, etc., in proper form. She should be competent to preside at a meeting or make a record of its proceedings, and the ability to do such things would make her a more efficient wife and mother. She spoke of the grange movement as recognizing the true position of woman, and considered it entitled to the support of all farmers and their wives.

EVENING SESSION.

The closing session of this Institute was occupied by Secretary R. G. Baird, who spoke on the Centennial Exhibition; by Mr. Lawson, of Utica, on the Application of Science to Farming; and Hon. J. Webster Childs on the Apple

Orchard. The last of these addresses was followed by a general discussion participated in by quite a number of the farmers present.

Pres. T. C. Abbot in behalf of the State Board of Agriculture and the Faculty of the College expressed their thanks for and appreciation of the hearty coöperation of the farmers of Rochester and vicinity in the work of the Institute, and also of their generous hospitality to the representatives of the college in attendance. Mr. Woodward and others responded, expressing the thanks of the farmers for the addresses given by the members of the college faculty and others who had taken part in the exercises.

At all the sessions of this Institute the audiences were large, and great interest was taken in all the proceedings.

ADRIAN INSTITUTE.

The Institute at Adrian was held, commencing Tuesday evening, January 18th, and continued its sessions during the following day and evening. The first evening session was held in Dean's Opera House, and although the exceedingly bad condition of the roads prevented many of the farmers of the surrounding country from attending, the hall was quite respectably filled. Pres. T. C. Abbot, Profs. R. C. Kedzie, Geo. T. Fairchild, A. J. Cook, and Mr. C. L. Ingersoll, from the State Agricultural College, attended this Institute, and took part in the proceedings. Hon. Thomas F. Moore ably presided, and on taking the chair made the following

OPENING ADDRESS.

Mr. Mickley was expected to preside at this Institute to-night, but on account of the bad roads he has failed to reach here. The professors of the Agricultural College are with us, and the evening will be taken up by a lecture on "Muck," by Prof. Kedzie. I wish simply to say that the noblest feature of our country is its educational institutions, and of these we may justly feel proud. In past years every industry, and the professions, aside from agriculture, have had their schools, and of late it has been found that agriculture could be benefited in the same way. To this end the general government has shown a noble generosity in making liberal endowments for the support of agriculture, not only in our own State, but in all the States of the Union; and we can now say, with the other industries and professions, we, too, have institutions where the specialties of the great field of agriculture are reduced to science, and made a science.

Following these remarks, Prof. Kedzie gave his lecture on "Muck." This lecture is given with others, at the close of this record of the Institutes.

WEDNESDAY MORNING.

The forenoon session, which was held in Grange Hall, was opened by Prof. Geo. T. Fairchild, who gave the following lecture on

DIVISION OF FARM LABOR.

In addressing farmers upon any subject directly connected with their work, there is this embarrassment: that a professor of literature is rightly supposed to

know less of the hows and whens and wheres and whats of agriculture than those whose interest is centered in such work. But you know the adage, "The looker-on sees most of the game." So you will bear with me if I claim to be an interested looker-on, whose interest began upon his father's farm in boyhood, and was fostered during college days by frequent returns to the farm for long vacations, while eleven years of service with farmer's sons and for farmers in our Agricultural College have confirmed it. There, every day brings its unanswered, perhaps unanswerable, questions, even into the private study.

Now the study of political economy opens a wide field for comparison of different facilities for progress in various callings, and I propose to offer to-day some observations upon Division of Labor, by way of comparing agriculture with other arts as regards this prime means of civilization.

Division of labor is simply a coöperation of several individual laborers in the perfection of any product, so that one finishes what another begins. It has been a power in the world's progress since "Adam delved and Eve spun;" but its increased application has brought the order of modern civilization out of the confusion of barbarism, and its further application, under proper stimulants and limitations, is to solve many difficulties for this very generation and time. Its special advantages have been most of them pointed out by economists. All are familiar with Adam Smith's famous illustration of the difference in ability of eighteen men working separately, and the same men working conjointly, at pin-making. He judged that each alone, perfecting the pins he worked on, could make but 20 pins a day, or all could make but 360; but each taking the simplest operation of cutting wire, straightening, pointing, polishing, sticking, etc., together they could make 90,000 a day,—more than 200 times as many.

This wonderful advantage is found in various directions. It economizes labor by saving time in the work itself, by avoiding change of work and tools; by shortening the necessary time of apprenticeship from the old seven years to two; by giving greater chance of skill in minute details, and of manual dexterity to express that skill; by adapting the different parts of the work to peculiar capacity, so that no power of mind or body is misapplied; and finally, by bringing just that attention to details that perfects the machinery employed. Invention in the broad sense is not fostered by division, because necessity, "the mother of invention," is little felt under a system that reduces each task to the easiest; and so the great machines like the steam engine, locomotive, power loom, spinning jenny, and cotton gin are the work of educated observers rather than of workmen; but minute perfections grow up under the minute attention of divided labor.

Capital is economized in as many ways. The shop-room required is far less, the tools and machines are fewer and better, the motive power is utilized completely with fewer intervals of action, the waste of material is less from the more perfect work, returns from sales are quicker from increased rapidity in the completion of work, and oversight, the most expensive kind of labor, is more effective and extended.

A well divided business is more stable than others. A union of interest binds the laborers together; steadiness of habit is fostered by the necessary filling of the niche assigned one; less real delay occurs in ordinary changes, because a place is easier filled; greater uniformity of production insures a steady sale; and wider market favors a less fluctuating demand for what is produced.

All these advantages are gained first in larger profits by the one who first applies this saving in any calling, and afterwards by all the world, in largely increased comfort with less labor.

Now in agriculture there has been little application of division of labor. The farmer is a man of all works, not to say "a jack at all trades." While in most of the arts the world is reaping every advantage from a full development of resources of all kinds, we are but beginning the development of plans by which the best results in agriculture can be reached. Food and what are called the raw products of labor do not diminish in value as manufactured articles do. While subject to extremes of fluctuation in particulars, in the bulk they are the most stable of commodities. A dozen staple products of the farm, taken together, form the surest standard of comparison for fluctuating values. Even gold is proved to depreciate gradually by such a standard. Since California and Australia opened their treasures, gold has become from thirty to forty per cent cheaper than before; but raw food takes a larger proportion of our earnings than thirty or forty years ago.

The cause of this high price is not to be found in monopoly, for there is no occupation where competition is stronger than in farming. It is not explained by a simple statement of the fact, as proved by universal experience. A partial explanation may be found in the exhaustion of fertility of virgin soils, putting farther from us the treasure we seek, just as we have to dig deeper for the ores and precious metals, or travel further for the stores of lumber in unbroken forests. Yet this is but a partial explanation. It often happens that we can afford more power at less cost of exertion. A pastime of my boyhood was the watching of teams, loaded with bog ore, daily passing to a furnace some six miles away. At a recent visit to the old home, the question arose, why had all this traffic ceased? The bog was still there, and apparently as productive as ever, while the furnace, though still in full blast, made no market for the ore. The question was put to the owner of the furnace, who answered, "We can get Lake Superior ore delivered at our dock for less money than it would cost to haul the bog ore." Here was a case where improved machinery and careful division of labor had abolished distance, and made six hundred miles less than six.

Doubtless a fuller explanation of the dearness of farm products is found in the fact before referred to, that division of labor has been less applied here than anywhere else, and each laborer is expected to be a good man in a dozen or twenty different operations, any one of which is as intricate as many of the trades. All this is not to disparage the farmer or farming by any means. There are a host of reasons why division of labor is naturally limited in this department of industry, so that it forms the notable example of natural limitations. These obstacles grow out of the peculiar agents and forces with which farming deals, as well as some conventional notions, the growth of centuries, under favorable conditions.

Of the first, we have peculiarities of climatic influences. The seasons bring their peculiar duties. Plowing and sowing and tilling and harvesting succeed each other according to the varying season from Spring to Autumn, and the work must change form wlth the succession. More than this, the work must accommodate itself to wet and dry, to wind and calm, to sunshine and storm. Many a day is lost entirely by the mass of farmers from an unexpected shower, and every sudden change brings its cost in the friction necessary in leaving one kind of work to engage in another. Nor is this all: the uncertainty of successive years makes a variety of ventures necessary. No farmer dares to risk his summer's labor upon any single crop, but must so divide his interests as to insure some return, even if the year be one of drought or one of deluge. This

also distracts attention and wastes effort, like having "too many irons in the fire."

Another set of obstacles grows out of the nature of the soil. The conditions of fertility make a rotation of crops a necessity, and the highest art is developed in adjusting it to circumstances of soil and surrounding. The necessity for manuring compels most farmers to divide their time and capital by a mixture of interests otherwise quite distinct, like grain and stock. Only where abundance of manure can be found ready made, can this be avoided.

The other class of difficulties grows out of a separation leading to isolation, which has always been a foe to progress in any art. The need of considerable space in broad acres fosters this. The farmer has few things in common with his neighbors, except the general interest in their common calling. Habits of independence are thus fostered, that extend into all the minutiæ of the work, multiplying the tools and machinery of farms, and diminishing the productiveness of labor. Perhaps no craft or calling more encourages jealousies of the trade. Each likes to do business for himself, even to the very manufacture and sale of his products, if possible. Other craftsmen indulge the same jealousies, but they are not fostered by the same isolation. Indeed, the demand for capital brings together otherwise competing interests in most of the arts, while need of space separates farmers. It is pleasing to see an effort in the direction of coöperation at the present time, for in union for a right purpose there is strength, not only against opposing forces in society, but also against the stern laws of natural forces. Every man aiding his fellow in the contest for victory over nature will hasten the millennium of labor, and receive now the "hundred-fold more" himself.

Now it seems possible to extend the work of coöperation by close attention to further division of labor among farmers. I offer only a few suggestions, which may be taken for what they are worth, and I shall be satisfied if they shall prove germs from which a fuller growth shall spring in any of your minds.

We see near large cities and along the great highways of trade a tendency to a somewhat full division of tillers of the soil into two great classes: farmers and gardeners. The farmers are ranked again as grain-raisers, breeders, feeders, and dairymen, while their farms take corresponding names. Gardeners are ranked as market-gardeners, fruit-culturists, and florists; and each of these classes may subdivide into specialists. Now may it not be possible to extend this far beyond the influence of these ready and stable markets by working together in production as well as in marketing, so as to insure some degree of stability and certainty?

It certainly is possible, in a stable community, to greatly increase the productiveness of a given number of cows in the dairies, by uniting in a cheese-factory. Every one knows that from the experience of years. Butter-making, under a similar system, is equally benefited, for every advance in quality is a saving, provided the quantity is not lessened. Marketing can be everywhere, as it sometimes is, the special work of a responsible agent, in which a large experience insures a good degree of wisdom. Very much better returns for capital invested in farm machinery might come from putting it into the hands of men trained to run it. We all know the various success that attends the use of threshing machines, and how experience fosters it. The same effect may be seen in use of the mower and the reaper. I found, last summer, a whole neighborhood depending upon the services of one man and his team for harvesting, and they saved money by it in quicker and more perfect work, with less

wear of machinery and horse-flesh, not to mention the idle capital in ten machines. How largely this mutual dependence might be found in this direction, I leave you to study. How few machines of proper capacity could accomplish all the work of a hundred farms, if handled by trained hands!

This spirit of coöperation, once established, will lead to a reform in many directions. I shall not be surprised to hear of a union in rotation of crops, or for extensive experiment in the perfection of seeds and methods of tillage. I feel sure of its reaching most of the manual operations of the farm, so that sets of trained hands may succeed each other in the progress of the crop. Once it was necessary that every farmer and his man should spend the greater share of the winter in swinging the flail to beat out his grain. The threshing machine, made possible by division of labor, reduces the labor to a fraction of its former bulk. Still more may be saved in similar methods applied to the tilling, curing, storing, and feeding of crops.

But without waiting for this new era in the manufacture of raw materials, some advance in productiveness of labor comes with every effort to assign particular duties to different men. A well ordered farm shows some approach to division, in assignment of many duties to the constant attention of the same hands. Responsibility for different fields or crops can sometimes rest upon separate shoulders; and the sons might early learn and practice some of the finer part of farming, were they made to share in this responsibility, and allowed to exercise their ingenuity aright.

Another step in the right direction is made by choice of a good rotation, in which the labors of one season shall not crowd upon those succeeding, and all may work together, with least machinery to rust out. Thus time and means are best economized, and the waste that follows haste is avoided.

Every discovery or invention that enables us to escape the uncertainty of crops from uncertain weather is a help toward division. If, by a thorough system of underdraining, waiting for the fitness of soil in the spring can be abridged, or the evils of drought and wet can be lessened, we are enabled to confine attention to fewer varieties and secure better results. Improved methods of tillage and curing, and protecting timber-belts may aid in the same direction. But most of all, some definite foreknowledge of the changing winds and storms is needed; and this we are looking for from the army of meteorologists studying the skies and the air throughout the land. If the laws of storms can be understood as well as the laws of light and gravity, no doubt we shall find them as perfect and certain as any of God's work.

There is one step to be taken by every farmer in this direction, without regard to wind or weather. That is to fix upon some line or rotation of culture suited to his taste, his capital, his soil, and his market, and *stick to it.* No business man succeeds who wavers from dry-goods to hardware, and then to fancy goods. So no farmer does good work as a farmer, however he may thrive as a speculator, whose fancy fluctuates from sheep to swine with every change in price of wool or pork. We all know how the fashion changes; but is there any worldly wisdom in following whims of trade to the destruction of an honest business? If "the shoemaker must stick to his last" in order to succeed, the farmer is in the sure way to productiveness when he stands by his best efforts in a given direction, and profits by each year's experience. Such a man will find his facilities for utilizing every moment of time and every cent of capital increasing with his years. If all would learn the lesson, almost one-half the uncertainty which attends the raising of farm produce for market would be removed. This

is no place for remarks upon the choice of any particular line of culture, of course, but the best of judgment should be brought to bear upon the subject, and the decision should be final as far as mortal powers can make it.

Now do not look upon these suggestions, however crude they are, as mere chimera, or as useless conjectures. Turn them over till a sensible side is seen, and then make them as much better as is possible; for by such thought upon the difficulties of our life and toil, human invention finds the true remedy. The facts certainly establish our necessity; it is for us to seek the supply, and every contribution, however slight, the world should welcome.

Mr. Ingersoll, foreman of the college farm, was next called upon, who gave the following lecture on

FARM DRAINAGE.

To the uninitiated, the mysteries of anything unknown have a peculiar charm; but when once known it immediately loses all its novelty, and we become but passive listeners to that which once we grasped for so eagerly. So, if in the course of my few remarks I fail to elicit anything new or mysterious, I beg leave to have you give a liberal share of indulgence while I call, for a few moments, your attention to the economic advantage of farm drainage.

To the farmers of this State this question has not presented itself in very strong light as yet, for the reason that if one has not land enough to work without draining, he has bought more and let his wet lands lie, or pastured them; or he has sold and bought again, where he would have more arable land. But the day is not far distant when the advice, "Go west, young man! go west!" will be changed into the advice, "Stay where you are, young man, and improve what you have!"

It would hardly be necessary to dwell on the advantages of better and more thorough cultivation; it is a fact patent to almost every one that farmers might do much more than they now do, on the same number of acres. Pliny, in his day, recognized this, when he gave his advice to brother Roman farmers, "Plow less and plow more;" *i. e.*, less in acreage and more times for a crop.

Drainage is either natural or artificial; and fortunate that man who has a farm with good natural drainage, by having an undulating surface with proper slope, and subsoil of that character that takes off surplus water efficiently and rapidly, without the need of ditches and drains.

But all have not, nor indeed could they have such farms if they wished, as in the general make-up of this, our world, it takes all kinds of soil and in every variety of condition. There is also this advantage of having lands that require drainage, *viz.:* they are largely among the best and strongest lands, and when once drained properly are the most productive lands we have.

What Lands Require Drainage?

It does not take a wise man to answer this question. Every farmer can tell what land of his farm would be improved by draining. But the point on which most would differ is the adequate means for accomplishing the result. The first farmer, perhaps, would think that an open ditch along one side of a field that would take off most of the surface water would be enough. A second would want more open drains,—perhaps one or two,—scattered over the field, and in the vicinity of these would succeed in obtaining a reasonable degree of drainage, and largely increase his crops. A third would ridge up his and, perhaps, and let the surplus water stand in the dead furrows, and slowly

evaporate during the early spring and summer. A fourth would perhaps want now and then a small tile drain, laid two or two and a half feet deep, in the smaller hollows, if the land were not an entire dead level; while a fifth would not be satisfied with anything less than a good system of thorough drainage, with tiles put in from forty to sixty feet apart, and from three to four feet deep. The others would stand aghast at such an outlay of expense, and very skeptically declare, "I don't believe it will pay."

We will start out with a comparison of an open drain and a tile drain of the same depth (and it costs double to put down a tile drain four feet deep that it does three feet deep, so that the disadvantage is on the side of the tile drain): First is the excavation. In a tile drain (fifteen inches being wide enough, and four feet deep) we have to remove 3.056 cubic yards of earth, nearly, to the rod, and replace it after laying the tile, making 6.112 cubic yards of earth to be moved altogether; and every one knows that it can be put back as easily again as it can be taken out, so that the work would only be equal to excavating 4.1 cubic yards. In the open drain of the same depth, *viz.*, four feet, dug with sides at an angle of 45° so as to stand, and one foot wide on bottom, there must be taken out 12 2-27 cubic yards of earth, or about three times as much work to dig the open drain as to dig and fill a tile drain of the same depth.

Then in order to have the land well drained, the open drains should be as close as the tile drains to produce the same result. Suppose we take drains 40 feet apart, it will take 66 rods of drain on an acre; and if, as we have shown, it takes 12 2-27 cubic yards excavating against 4.1 to the rod in favor of tile drain (and without saying anything about leveling the unsightly ridges that are scattered over the field where the open drains are dug, before we can cultivate), there is a difference of nearly eight cubic yards of earth per rod to move, and on 66 rods this would make 528 cubic yards to move on one acre more than in putting down tile drain. If we double the distance between drains, then there will be half this difference, or 264 cubic yards. The moving of 528 cubic yards of earth, and leveling would more than offset against the 1,089 (or in round numbers the 11,000) 12-inch tile required to lay an acre, and which cost about $11 exclusive of drawing.

We will next proceed to consider the amount of land that lies idle in the open drains. If we dig four feet deep and one foot on bottom, according to the rule "To twice the depth add the width on the bottom for the width on top," it will give a ditch nine feet wide on top; and add one foot more for margin in cultivation, we have on one acre a strip of land 66 rods in length and 10 feet wide, or just 40 square rods,—one fourth of the land. If the drains are 80 feet apart, one-eighth of the land idle.

But why drain so deeply? many will ask. A majority, perhaps, think it nearly useless work, and not economy. Yet they would give their stock the best kind of care and feed, forgetting that plants must feed on deep, porous soil, and soil that is not saturated with water; for where soil is saturated with water the plants soon grow sickly and pale, and their rootlets do not go down and ramify through three or four feet of soil if in that condition. Many of you would be astonished, may be, if I should tell you that the students at our Agricultural College, while in pursuit of their studies, dug up clover that had penetrated to the depth of four feet in clay soil; and wheat roots I saw 3 feet and 2 inches in length, and broken off at that. This was on a well-drained ridge, and where the roots had ample chance for feeding. Almost all our plants root very much deeper than people generally suppose, and one of the best means of know-

ing when your land wants draining is to find how deeply plants root under the best conditions; and then, if you find a place where they are confined to eight or ten inches of surface soil, on account of hard subsoil saturated with stagnant water, or even with cold spring-water oozing gradually from the hillside, as it frequently does, *drain at once.*

And now we come to the question,

Will it Pay?

This will depend on four conditions: 1st, the value of land; 2d, character of soil and subsoil; 3d, the productiveness after drainage; 4th, the character of the work on drains. We will proceed to look at these four conditions in their reverse order, and 1st, "The character of the work on the drain:"

It is an old adage, that "Whatever is worth doing at all is worth doing well;" and no where is this more applicable than in tile draining. We should first have a definite plan from the start, and work to that plan. Have the level stakes stuck, and know where the best outlet will be. Then select none but the best cylindrical tile, and reject all broken and defective ones. Get none but workmen on whom you can rely, if you cannot do the work yourself, or be there all of the time to superintend, as two or three carelessly laid tile with defective joints in some important place may destroy half the effect of draining on a large tract or portion of a field.

I wish to put this very strongly, so I repeat, Better superintend the laying of every tile yourself; for once well laid, they are silent workers for a century. Be careful not to lay them near any bunches of willows, or near elm trees that are living, as they will send roots that will completely fill up a tile and choke it. There was a tile taken up from Field No. 5, on the College farm, this year, that was filled with the fibrous roots of an elm tree that stood near the drain, and obstructed the flow of water, and the drain had only been laid three years. So you see we should leave no stone unturned in doing everything to make a drain thorough in its work and lasting in its benefits.

This is one reason why farmers so often condemn it, as they say, after a trial of its merits.

2d. We should consider the productiveness of the land before and after draining.

There is much difference of opinion in regard to the improvement caused by thorough drainage. Many farmers would be satisfied with an investment that would pay 10 per cent. a year, except in case of draining. They would think that if they did not get immediate returns, say in one or two years, it did not pay. But just wait a moment. Drains, well put down to a proper depth, will last, at the least calculation, twenty years, and much longer if the proper precautions are taken. If, then, the crop is increased one-tenth by draining, a man who has the money to invest has realized 10 per cent for money invested. But if, as is nearly always the case, the farmer receives from 25 to 50 per cent, and even 100 per cent, he soon gets his pay back, principal and interest, and has his drains left, and soil in condition, with proper farm economy and manuring, to repeat this year after year. An instance of this kind comes to my mind now, where a farmer drained a low field with excellent soil that had nearly always failed to ripen about a half crop of corn. After a thorough system of draining, the crop was doubled the first year after the drains were put down; and to use the words of the farmer himself and (by the way an honored member of our Legislature),

"I would scarcely have believed it if I had not seen and tried it. The first crop almost paid for draining."

3d. We pass to notice that the character of the soils and subsoil has much to do with the pay question.

I would not have you think that, like a patent-medicine vender, I would recommend this as the only panacea for all soils and conditions of soils. Nothing could be farther from my intention. There are soils so poor in a state of nature that any amount of draining, manuring, etc., could hardly make them habitable. I will only speak of one or two conditions. I have in mind a farm which has about 30 acres of soil apparently rich enough, but of sandy loam and gravel, underlaid by light quicksand that comes within two feet to eighteen inches of the surface. Crops always look poor, and heavy manuring seems only to relieve for a single crop the monotony, and not then is the land affected as other land is. The plants will not root in this quicksand, and the manure put on leaches half away, going into the quicksand, and passes off below where the rootlets ever feed. Draining would only help such land in a measure, by deepening the feeding-ground of the rootlets. The leaching could not be hindered. There are lands that seem to be full of the ferrous sulphate in solution, and only by a long process of oxidation can this be changed to the ferric sulphate, and most of us have not the *time* to wait for such lands to become productive by drainage, even if we had the funds and disposition. And sometimes we find soils that do not seem to have the requisite food for plant growth at all.

4th. Will it pay to drain on all lands, irrespective of price?

We would answer, No. If lands were from $10 to $15 per acre, it would hardly pay to lay out from $25 to $40 per acre on drains, when for that amount you could buy from one to two acres more of land to cultivate. It is only when the pioneer system of farming has passed away, and men have land worth from $30 to $100 per acre, that it will pay to follow a thorough system. But you may ask, Why bring this subject before us, when more than half our State is just undergoing settlement? The reason is this: that to be forewarned is to be forearmed; and we have faith to believe that the southern four tiers of counties of this State could be very much benefitted if the farmers who own lands that need it were fully awake to the subject of draining. It is a lamentable fact that our beloved Peninsular State is falling behind, according to statistics from the Department of Agriculture, year by year, in the amount of wheat, corn, hay, oats, etc., produced per acre, so that the average for the whole State is about eleven bushels of wheat per acre, and shows our State to be tenth in wheat culture, per acre, ninth in oats,—raising about 29½ bushels per acre, and 31.4 of corn.

Let us compare with England in 1867, with an average of 26.7 per acre. They have better farming there,—better drainage. They believe in plowing less and tilling better; and this is what we, as farmers, want to school ourselves to.

Suppose a man sow 20 acres of wheat a year, and raise from 18 to 20 bushels per acre, and that by thorough cultivation and drainage he increase this to 30 bushels per acre: he would then have to sow only 13⅓ acres, at 30 bushels per acre yield, to raise as much as before from 20 acres at twenty bushels per acre, or 6⅔ acres less. He would then save the use of 6⅔ acres of land, and the cost of putting in 6⅔ acres of wheat and seeding, which is not far from $10 per acre. When looked at in this light, it will pay to drain and cultivate better, and every farmer should be awake to the fact.

I have said very little about cost and methods. Mr. French, in his American Farm Drainage, estimates that with labor at $1 per day, and tile (12-inch) at $10 per thousand, drains can be put down in soils that do not require the use of a pick, at a cost not exceeding fifty cents per rod, and varying from twenty cents to that, on a majority of soils that want drainage. Drains at intervals of forty feet will be near enough, and if they can be put down at forty cents, it will cost $26 40 to drain an acre, or about $25, if not too hard digging. There are many fields that would not require over half this amount expended to increase the production one-fourth, and as most farmers have men hired by the month, and sometimes at less wages than one dollar per day, their drains would cost them even less than these figures I have named.

Before I conclude, let me mention a few of the more immediate advantages of draining; and first let me mention the pulverization of the soil so as to be much lighter to work, as the farmer calls it; and if properly drained, he has not to wait more than forty-eight hours after severe storms before he can go on with his work. It also prevents surface washing, and causes the filtration of the substance of the manure through the soil, and is then taken up by it. In proof of this, let any farmer take a section of soil twelve inches deep, and filter a quart or two quarts of liquid manure through it, and note the difference in the color of the liquid before and after the filtration. The soil takes hold of all the ammoniacal salts and ingredients it stands in need of, and lets the rest go. 2d. It lengthens the season for cultivation, and in the corn crop alone who can tell how often we may have seasons when ten days' difference in the growth of a crop may decide its ripeness and hence its worth? 3d. In fields sown with wheat it prevents the freezing out in spring. 4th. It is much better for hauling loads off and on in spring, or in a wet time. 5th. It will pay to drain land in the ease and greater comfort of working it; and as has been said, "he who makes two spears of grass grow where but one grew before is a public benefactor," then we may all become public benefactors. We will find, I think, that it pays to limit our work in area, and do it thoroughly.

DISCUSSION.

Wm. Graves of Palmyra.—What the gentleman has said I believe to be true. I have received great benefit from tile draining. I have not drained quite as deep as the gentleman has recommended, but I think I have received pay for my trouble and expense every two years. I would recommend tiling to all our lowland farmers.

C. A. Jewell of Hudson.—I have had some experience in tile draining. I do not pretend to know everything about it, but there is one thing that the farmer should know: and that is that his tile are properly laid. I have about 35 rods of drain that I shall be obliged to take up. The man who laid it put it down by the rod, and made bad work. This drain became obstructed, and I dug down and found that the tiles had lapped by each other, and the crabs had worked in and filled up one of the tile. I replaced it, but the whole drain must be dug up and relaid. There can be no better advice given to farmers than this: that they superintend the laying of their own tile.

Horace Sayles of Palmyra.—I can say that I have been benefited very largely by tile draining. It has cost me $10 per acre to drain my farm. I have had very little difficulty with my tile not working properly. I laid a string of tile once near an elm tree, and the drain became obstructed. I dug down and found that the roots of the tree had penetrated a soft tile and filled it to a great

extent. The tile should be sufficiently large to carry off the water. I lay my tile from eighteen inches to three feet under ground, and about four rods apart. I had one field that was imperfectly drained. I sowed to wheat, and got about three bushels to the acre. I never had got a crop on it that paid for the labor. I drained thoroughly, and planted to corn about the middle of June. I then sowed to wheat, and got 27 bushels to the acre. Care should be taken to not lay three-inch tile where six-inch are required to carry off the water.

J. W. Helm, Adrian.—Six or seven years ago I went about half a mile from the city and purchased a piece of land on the bank of the river for a fruit and vegetable garden. This field of five acres descended towards the river, and the highest portion of the ground was tenaciously hard clay. I drained this ground thoroughly, and I found that in the hard clay it increased the earliness of the vegetables in my garden from ten days to two weeks. In addition to the drainage I manured this ground highly. Furthermore, I tried to see how much I could raise on this ground. I set my apple trees about three rods apart, Then pear trees about twenty feet apart. Between each pear tree I shoved in a peach tree, between each peach tree a Concord grape, and between these black raspberries; and between the trees I cultivated vegetables. When my apple trees got to bearing the result was ten or fifteen barrels of apples, twenty-five or thirty bushels of raspberries, and two tons of grapes. The vegetables which I grew there were immense. I think that a great deal of my success came from tiling. It not only enabled me to get my vegetables in earlier in the season, but it prevented the manures from being washed off from the top by the heavy rains. The water would settle into the drains and come out clear. Just as quick as the frost is out of the ground the water finds its way into the drains, and my garden is ready for the plow.

L. C. Drake of Madison.—The question with most of us is not one of per cent and profit, for we have been satisfied in regard to that for some time; but it is a question of labor,—how we can get it done at all. In the section where I live very few men are able or willing to dig ditches. While good farm labor can be procured for one dollar per day, it is impossible to get effective workers to dig ditches, even at two dollars per day.

Mr. Helm.—I will state that I put down my own tile. I first ran a furrow with the plow, then turned and ran a furrow the other way. I made the ditch about two feet deep, and then there was very little digging to be done.

Mr. Ingersoll.—In regard to filling the ditch, Prof. Gulley uses a broad scraper made of plank, with which one man with a team can do more filling than six men can with shovels.

Mr. Moore.—I would ask how much fall is necessary in order to have a drain work well?

Mr. Drake.—If I could get a fall of a foot or two to the mile I would drain, provided I had an outlet that would not dam up.

Burton Kent.—My experience has been mostly confined to drainage in the city, and we consider if we can get a foot fall in 450 feet that is a pretty good fall. I have no doubt that a foot to the mile would be sufficient to drain our farm lands, because you have the pressure from above. If you put your tile down four feet, you have the pressure at the surface, which is equivalent to four feet fall.

Calvin Craine, Adrian.—I have had very little experience myself in tile draining. Am of the opinion, however, that the laying of tile may be made very profitable to the farmers who have low lands which need draining. In fact I

believe that nearly all clay lands would be greatly benefited by tile draining. The remarks made by the gentleman in regard to care in lawing the tile should be well weighed, especially if the drain passes through a bed of quicksand.

Mr. Ingersoll.—Quicksand is the worst thing we have to contend with in laying tile. The best plan is to cover each joint, as fast as you get it laid, with sod or clay. The fall of the drains on the College farm is about one-tenth of an inch to the rod, or thirty-two inches to the mile.

Charles E. Mickley.—There is no subject connected with the farm in which I am more interested than that of tile draining. I have had considerable experience in the work, and I feel like endorsing what has been said in relation to exercising care in laying your tile. If this work is not well done you will soon see the necessity of doing the work over again. I have, on my farm, three miles of drain, and I think every rod of the tile I laid myself. My ditch digging is done by one man, Mr. Beck, and I can recommend him to all the citizens of this county who want work of this kind done. I have put in a great deal of board drain, which was cheaply made and worked to good advantage. I take, for instance, two pieces of board for the sides, covered with a strip of plank on top, leaving the bottom open. My ditch digging costs me $2 50 a day, and I consider it cheap labor at that price. So far as the benefit to the soil is concerned, where drains are properly constructed, I am well satisfied; and I am confident there is nothing needed so much in Lenawee county to increase her yield of agricultural products as a thorough system of drainage.

C. R. Potter, Madison.—I have a marsh of five or six acres which about 15 years ago I drained enough to carry off the surface water. I mowed it for many years, and finally put in tile drain. I thought there was plenty of fall at the time, and I put in my tile 2½ feet deep. Last fall I plowed the marsh, and in a great many places the plow would strike the tile.

E. Beals, Dover.—I have five acres of marsh on which I have 150 rods of drain. It was the current talk that it had a quicksand subsoil. A portion of it was covered with shaking poplars. I constructed my drain of boards, leaving the hole inside four inches square. In many places, when we were laying the drain, the soil was not sufficiently firm to sustain the weight of the boards, and the ends of the box would settle down. We obviated that by getting straw and putting it around these joints. This drain has been laid five years, and is still doing good service. Last year I had a splendid crop of timothy on this field, and the year before I raised 22 bushels of wheat to the acre. That shows me the great benefit in tile draining.

Prof. A. J. Cook was next called upon, who gave his lecture on "The Three Worst Insects." (See lectures and discussions following this record.)

AFTERNOON SESSION.

At the close of the discussion which followed Prof. Cook's lecture, Prof. R. C. Kedzie gave his lecture on "Plaster." (See lectures and discussions as above.)

Pres. T. C. Abbot was next called upon, who gave an address on the "Agricultural College." At the close of Pres. Abbot's address Hon. Chas. E. Mickley was called upon, who addressed the audience as follows:

I have been very much interested with the discourse of President Abbot, and feel like endorsing what he has said. I think it was in 1863 that I first visited the college, and I had rather an unfavorable impression of it; not of the central

idea of the institution, but of its location. I felt at that time that we should choose some more favorable location, further south. With the thought that the college could never be made a success in its present location, I did not do much in the way of legislation to help the institution; but in later years I changed my mind. The college has become a necessity; and although it is not as well located as it might have been for the best possible results, still, things have gone so far that I would not raise the question of changing the location, and I think it never will be raised in the State of Michigan. The institution has more than met my most sanguine expectations, and I can safely say that the farmers may justly feel proud of the State Agricultural College.

Now, do the farmers of Michigan need such an institution? I answer, yes; for if there is a class of men in the world who need an education it is the farmers. If there is a man who should hold up his head and feel himself a man, it is he who tills the soil for a living. One object of the Agricultural College is to add dignity to labor, and it has done it.

The means for the support of our educational institutions are furnished by the tax-payers of the State, and we hold the graduates from them somewhat responsible to us. Not that we expect that they will pay back in dollars and cents the outlay which is made for them, but that they will return the fruits of the culture which they receive. Now the agricultural college is doing these things. We pay the appropriation as farmers and mechanics, and it is right we should have an institution which makes this great central idea of agriculture the leading one. It is our institution, and it is well for us to look after it.

EVENING SESSION.

The closing session of this Institute was opened by Dr. R. C. Kedzie, who read a paper on "Lightning Rods."

Mr. Seigler of Adrian made the following remarks upon the use of

LEACHED ASHES FOR WHEAT CROPS.

My father commenced farming in eastern Ohio about 55 years ago, and consequently we had a great deal of timber to dispose of. We had cleared twelve acres of very heavy timber, and had about six hundred bushels of ashes which we tried to sell, and could only get about four cents a bushel. We then concluded to work them into salts, by leaching them and boiling down the lye. This was in the spring of the year. We threw the leached ashes into a pile, where they remained until fall. We had a piece of wheat of about four acres, and after it had got nicely up and rooted we distributed the leached ashes over about three and one-half acres. There was a marked difference in the looks of the wheat until harvest time, and the part which we ashed yielded thirty-three bushels per acre. I think the ashes increased the yield about one-third. That is about all I have to say in regard to the use of ashes on wheat. The ground had been cleared eight or ten years previous to the application of the ashes. The soil was heavy clay.

Prof. Cook.—Mr. Mickley has referred to the light soil about the college buildings. In trying to get this land well seeded Prof. Beal has used ashes with marked effect. All the grasses have been greatly benefited by sowing ashes upon them, especially the white clover.

Prof. Kedzie.—There is no doubt that the condition of light soils can be

greatly improved by the use of ashes. In traveling about the country I see large deposits of ashes which are left to go to utter waste.

Mr. Helms.—I have about five acres of ground on which I have put hundreds of bushels of ashes. I have kept it seeded most of the time, particularly the orchard. For three or four years I covered the ground with ashes an inch deep, and I have mowed three tons of grass to the acre and raised large crops of apples at the same time.

Dr. Owen, Adrian.—In my small orchard I had three trees of the Newtown pippin variety which would never bear until I applied lime, leached ashes, and plaster freely, and then they bore as fine specimens of the Newtown pippin variety as I ever saw in western New York, and about three barrels to each tree.

J. T. Ludlow.—My father once experimented on a field of wheat with unleached ashes, sown broadcast from a wagon, and increased the yield of wheat from 30 bushels to the acre where it was not ashed to 45 bushels where the ashes were sown. This was in the State of New York; and from that time my father always sowed ashes on his wheat, and with the best result, using thousands of bushels in this way. I have been engaged in an ashery for a number of years in this place, and I have made great exertion to get the farmers to take away the ashes, by telling them of the wonderful results which might be accomplished by their use, but they never could get rid of the idea that leached ashes were good for nothing, and I have had to scrape 10,000 wagon loads into the river. One farmer, who had no faith in leached ashes, had a dry, gravelly knoll, on which he could not raise white beans. I finally offered to pay him for his trouble if he received no benefit from their use, and he drew away 15 or 20 loads and scattered them on the knoll. The result was, the heaviest wheat he had grew on that poor, barren knoll. I think leached ashes are preferable to unleached ashes.

C. L. Ingersoll.—I have seen unleached ashes mixed with plaster, half and half, and used with the best results. I would advise every man to save his ashes, and put them back upon his land.

Mr. C. L. Ingersoll next gave his lecture on "What stock shall we keep?" (See lectures and discussions as above.)

Prof. G. T. Fairchild was again called upon, who gave his lecture on "Education: who need it and who can afford it."

At the conclusion of Prof. Fairchild's address A. D. Hall moved a vote of thanks to the Professors of the Agricultural College for the part taken and interesting addresses delivered by them during the Institute. Prof. George T. Fairchild, on behalf of the college, returned thanks for the kind attention shown, and the Institute adjourned.

INSTITUTE AT COLDWATER.

The Farmer's Institute at Coldwater was held, commencing on the afternoon of Thursday, January 20, and continued its sessions during the following day and evening, which were well attended by the farmers from the surrounding country. It was ably presided over by Hon. Cyrus G. Luce. Seeley's Hall, in which the meetings were held, was decorated for the occasion. A fine variety

of fruits and other products of the farm were arranged in front of the platform. A choir of singers from Gilead, Batavia, Girard, and Coldwater furnished excellent music. The following representatives of the Agricultural College attended this Institute and took part in the proceedings: Pres. T. C. Abbot, Profs. R. C. Kedzie and A. J. Cook, Secretary R. G. Baird, and C. L. Ingersoll, foreman of the College farm.

The first session of the Institute was opened by President Abbot, by an address on "The Agricultural College." (See lectures and discussions following this record of the Institutes.)

President Abbot was followed by Mr. Luce. (See addresses and discussions as above.)

THURSDAY EVENING.

In the evening Prof. R. C. Kedzie lectured on "Plaster" and "Lightning Rods." This, with the discussions which followed (for which see addresses and discussions as above), occupied the first evening session.

FRIDAY FORENOON.

After singing by the choir, the chairman, Mr. Luce, introduced Prof. Cook, who gave his lecture on "The Three Worst Insects of the Farm." (See lectures as above.)

AFTERNOON SESSION.

After opening exercises by the choir Mr. C. L. Ingersoll was introduced, who gave his lecture on "What stock shall we keep?" (See lectures as above.)

After the discussion which followed Mr. Ingersoll's lecture, A. J. Aldrich gave the following address on

THE FARMER'S DUTY TO HIMSELF, TO HIS FAMILY, AND TO SOCIETY.

In the consideration of this subject we must remember that the conditions of the farmer's life are different in this country from what they are in Europe or elsewhere. Here the farmer is his own laborer. In Europe we find few who are called farmers, while there are multitudes who act simply as machines, working under the will of the master. Here each must exercise his own genius and ability. There the laborer puts forth brute force, which is guided by the knowledge and skill of another. Population is not so dense, nor land so costly in this country, but that every man may possess and manage his own little farm. The result is, the ratio of laboring men to farmers is much less here than in the more thickly populated countries. Farms are small, and each plantation, however limited in extent, is supposed to have its guiding spirit, which calculates, prepares the soil, sows the seed, harvests the grain, carts it to the market, receives its equivalent in an exchangeable currency, votes, and pays his taxes, and if, indeed, he be fortunate enough to have any left, spends the remainder according to his own sweet will and pleasure. We have a class of gentlemen farmers who are making great investments, and who, because of their ostensible interest in the profession, receive much attention, solely on account of the magnitude with which they are conducting their enterprises. But these are not the typical farmers of the country; they are only a kind of saplings which thrive on others, but bear little fruit.

But the great difference between the farmer here and his equivalent, the laborer in Europe, is the grand, glorious, and transcendent fact that he is an American citizen, vested with rights that make him a ruler,—a sovereign within his own propriety. It is this fact of superiority which startles other nations, and causes them to look on with amazement at the progress already made, and a vast amount of incredulity as to what the result of it all shall be. *Can we make all people, of whatever occupation, intelligent citizens, is the problem.*

There are some facts contained in the statistics of this country which bear upon the subject we are to discuss, and for a moment let us consider them.

According to the census report of the United States for 1870 the population over ten years of age is 28,228,945. Of this number, those engaged in some occupation amount to 12,505,923. There are engaged in agriculture 5,922,471; very nearly half of the employed inhabitants of the country. Is it not desirable that these should wield an influence commensurate with their intelligence and numerical importance? These tables unjustly state that the number of unemployed females is 12,133,791. This places the wives of those men engaged in some pursuit among those who are unproductive. But the wife and daughter of the farmer are equally entitled to be placed among the productive elements of society, and future statistics should recognize this fact.

In this State, according to the census of 1874, just issued, 166,614 persons are engaged in agriculture, out of a total of employed persons of 358,280;—nearly half, it will be perceived. There are engaged in professional and personal service in this State 83,886; in trade and transportation 28,973; in manufactures 70,581; in mining 5,782. There is but one who boldly declares himself a middleman, and but one who calls himself a pettifogger; and neither of these were reported from the county of Branch! There are 1,563 persons who consider themselves qualified to act the part of legal counselors, while there are 1,759 clergymen and 176 editors,—enough, it will be seen, to offset the evil which the lawyers may work in society.

Agriculture in this country possesses still another element of strength besides that of numbers: it is the strength of capital (provided all their debts are paid). But the law recognizes it all as his, by making the real-estate owner pay taxes on what he owes as much as on what is his in actual right,—an injustice, surely.

The value of the farms of this nation, as estimated in 1870, was $9,262,803,861. This is the real estate; while the capital invested in implements amounts to $336,878,429, and the value of live stock is set down at $544,180,516. This makes a grand total of $10,143,862,806. The value of farm productions during the same year was estimated at $2,447,538,658.

With these figures before us,—so vast that our minds cannot comprehend them,—is it not proof sufficient that the agriculture of this nation should be accorded the front rank in its industrial and commercial importance, while the numbers engaged in this pursuit entitle it to a more generous recognition at the hands of all other business and professional men? Does it not also show that this greatest of all professions deserves a higher degree of respect, not merely from all other classes of society, but from those who are engaged in it? In a most important sense a man's profession is just what he makes it. If he chooses to dishonor it by his acts, so far his calling may be in disgrace. But it does not depend upon one man. The average character of the men engaged in it makes the profession honorable or dishonorable. We think the time has come in the history of agriculture in this country when those engaged in it are determined that the profession shall be elevated into the rank of the learned professions, and this feeling is reaching down into the mind of the average farmer. This is

a matter for which the farmers are deserving of congratulation. With these introductory thoughts before us, is not the farmer's duty a subject deserving our most careful and attentive consideration?

In the first place, then, let us consider the farmer's duty to himself as a man of business.

From the statistics presented, we have seen that the farmers, as a class, possess great importance both numerically and by reason of their aggregated wealth. Should they not possess an equal amount of knowledge and skill, and be thoroughly conversant with every detail of their business?

The banker, when he first engages in that pursuit, does not rent a building, put in his vaults, display what little money he may possess, and then expect that men will entrust their deposits and collections with him. These cannot be the sum total of his stock in trade. He must be a man who is recognized as possessing such knowledge of the rules and forms of business as to perform his work correctly, and thus beget confidence. The more perfect his knowledge of all the intricate questions involved in money, commerce, and exchange, the greater will be the reliance placed upon his judgment, and his prosperity is more fully asured. Just so it is with the lawyer, the judge, the statesman, the manufacturer, or any other business man. The same rule is verified in the history of the most successful, wealthy, and respected farmers. Some have been so unwise as to claim that education of the higher grade does not better agriculture. President White, of Cornell University, hits the nail squarely on the head in speaking of this very point: "If this be true," he says, then is agriculture the only industrial pursuit unworthy of a human being; for this assertion would not be made against any other branch of human industry." The Professor then, in referring the student to Herbert Spencer's Tables of Progress in his Comparative Sociology, adds, that there you will "see that skill in observation and reasoning on observation have been steadily improving agriculture, at the same time that they have improved other industries."

Our farming would be better if there were greater consecration to the work. It is too often simply a means to an end,—and that end is to get sufficient means to engage in some other business and then leave the farm. The profession of farming ought to descend from father to son. It is the concentration of the powers of mind and will upon one's profession that makes the man successful. The chances for success would be greatly enhanced if our young men would stick to the farm, adding to the knowledge received from the parent that which would come by additional study and experience. By this means respect for the profession and the wealth of the country would be increased, because we should have qualified farmers instead of new and inexperienced and unskilled workmen. Every profession is burdened with the men who rush in thinking they can make more money and attain greater success than in the profession they left. But they lose sight of the fact that the successful men are those who have given years of study and practice, and suffered many inconveniences before they attained a position where real success was possible. The young men should not leave the farms, but add to the knowledge, gained in youth, greater skill and wisdom, which shall make them eminently successful in the pursuit in which they were brought up. In the end they will find themselves much more highly respected and honored.

It is a most untruthful saying that "such and such a man is only fit to be a farmer." Now I will not tickle the farmers' ears by telling them that they are not responsible for this saying. The farmers of the past and present are to

blame for it because of the slip-shod methods by which the great majority have been in the habit of conducting their business, and because they have supposed that muscle was the great and essential thing in successful farming. They have overlooked the fact that while knowledge in certain details of execution was absolutely essential, a knowledge of general propositions was also equally valuable. The best farmers are those who, to skill in performing, add also the wise forethought which conceives, develops, and executes the plan of a campaign, which on the farm varies more or less with every season. Most of the farmers of to-day, while awakening in a measure to this fact, have not yet become so thoroughly imbued with the principle which lies at the bottom of it, that they are ready to give time for study and risk a little capital in the investment. This higher plane upon which the farmers of this country must eventually stand is to be attained only by a devotion of hand and head and heart to the pursuit which they have chosen. Science will aid much in securing this end. But science demands study. Observation in the field will aid still more. But observation will accomplish nothing except the reason be put to the task to form a principle or a law.

Does the average farmer,—*average farmer,* I say,—exercise this God-given right of thinking and reasoning? Is it not more common for such a farmer to prosecute the details of his work too much as a matter of form and habit without, by any process of reasoning, deciding whether he is acting the most wisely? Does he think whether that is the best crop to put upon that field? or whether he applied his manure in the best manner or at the best time to secure the largest crop? or has he ever stopped to calculate whether he is not actually losing every year by giving so much attention to one crop? or does he stop to consider how by some changes in his management and tillage he might improve his deteriorated soil, thus adding to his income and value of his property? Indeed, does he think of improvement at all? Such a man needs a terrific shock given to his old habits which shall cause him to develop the fertility both of his brain and his lands.

The farmers as a class, I believe, are awakening to this higher consideration of their calling. They have been too much in the habit of considering agriculture a profession wherein only brawn was needed, and the man who had the hardest muscle and greatest amount of physical endurance was the one to eventually succeed. Now, however, we begin to realize that there are elements to be analyzed, and brawn cannot do this. There are subtle laws which escape our notice unless we are ever on the alert to detect them, and brawn cannot do this.

There are pests which infest and destroy our fruits and crops, and brawn has not yet been able to destroy them. There are rules which must regulate trade in which the farmer is interested, but brawn can never arrange these laws, or tabulate the facts upon which they are based. It is this brain-power which the farmer of to-day needs most to cultivate. He should store his mind with the facts which natural science is bringing to light, and acquaint himself with the principles which underlie successful agriculture, and, in truth, all successful trade. The farmer should also reach beyond his own calling, extend his acquaintance with men of other trades and professions, and by comparing the *relative* importance of other kinds of business with his own; by studying into the necessity which has created other trades, he will find the middle wall of prejudice crumbling away, and a better understanding and a better feeling will be engendered. It is the farmer's duty to recognize the relative position of

every kind of labor in the scale of human industry. He cannot isolate himself and declare himself independent of every other. Each is dependent on the other, and all are calculated to fill a niche in the temple of human progress.

We shall probably find work laid out for a lifetime; but what is life for, if not to improve the powers which God has so graciously bestowed upon us? If I mistake not, there will be much satisfaction experienced in this work of individual development, which will repay us fully for all the time and money spent in the task. Living means activity; otherwise it is mere existence. As Emerson says: "We live by desire to live; we live by choice; by will, by thought, by virtue, by the vivacity of the laws which we obey, and obeying share their life; or we die by sloth, by disobedience, by losing hold of life, which ebbs out of us."

Ought we not, then, with sacred ardor, firmly to determine that we will concentrate our energies upon this task of development, "nor," in the language of another, "pause to waste a coward thought on life?" This individual development has two objective points toward which the person will find he will be called upon to exercise all the knowledge, the wisdom, and skill which he may possess. These are, first, the growth and elevation of the family; and second, the progress of society. These two propositions we shall now endeavor to consider.

I have often felt that, as men and women, we do not recognize the full importance and the solemnity of the family relation. The evidence of this fact is found too often upon our court records, and is read in almost every city daily. In making men fathers, John Calvin said that God had bestowed upon them His own title; and with it came responsibities which, if properly met, yield a grand and noble return; or, if their importance is slighted, will yield a return which brings tears and premature sorrow. Were it in my power, I would impress this responsibility upon every man who is the means of bringing into life an immortal soul. Not only is he accountable for its existence, but also for the training which must follow to raise this human being to the rank of intelligence, reason, and judgment.

The family is only society on a small scale. It was the heroism of Roman mothers that made the successful generals of that period. It was the training of the minds and hearts of the Roman youth under the direction of the most learned and skillful teachers, philosophers, and lawyers, together with the pride of Roman citizenship, that made the patriots and statesmen and orators that adorned the Senate and the Forum. And within the confines of our own nation we shall find the Jeffersons, the Adamses, the Monroes, the Jays, the Franklins, the Clintons, the Websters, the Morses; and every one of them is the product of thorough training and severe discipline. And to his dying day, although his life went out under financial disaster, brought on by lending his credit to a friend, Thomas Jefferson enjoyed the quiet of his rural home up among the mountains of Virginia, and often seriously thought of withdrawing from public life to the retirement of his farm, and give his attention to the care of his estates. Most of the prominent men of Revolutionary times, while being trained in a knowledge of science, law and politics, were owners of large tracts of land, from which they received most of their livelihood. Their fathers before them were farmers, and they thought no profession so independent and honorable. To-day, in England, that man is of little account in the political movements of that country who cannot boast of his finely-cultivated fields and extensive hunting grounds.

Why is it then that in this land and in this time, where and when the ner-

vousness of freedom excites to emulation, our young men and women, reared on the farm, gravitate toward the centers of population? In the old country, the rush is to escape the foul, putrescent air and fumes of the city and its constant whirl of business and its unwholesome stimulation that they may seek the quiet, unassuming, healthy and invigorating life of the farm. Here we have all the pleasure, beauty, charm and health of rural life, and crowd into the cities only to enervate our physical powers, raise a degenerated progeny, and shorten our own lives.

Is not the home-life of the farmer, in a great degree, responsible for this desire to leave the farm? Has not a too rigid economy—or rather economy exercised unwisely and in the wrong place—created a distaste for that which is the great source of enjoyment and improvement? Has not the farmer too often shown a disposition to repress the ever active and inquisitive mind of his child when he should have placed before him the means of satisfying this thirst for a knowledge of things? The mind seeks contact with others, thus producing "fruitful collision and friction of mind with mind." It is not possible to erect a high barrier, like a Chinese wall, around his tentative disposition, expecting it will remain in solitary confinement. The prison cell was made for the criminal and not for the free, acquisitive, out-reaching spirit of the youth.

A farmer's home should be surrounded with all that help to improve and draw out the faculties of the child. The parent should manifest an interest in improvement, by himself adding some grains of knowledge to his own stock, thus setting an example worthy of imitation before his children. Let him supply his home circle with the best works on agriculture. Let him secure the records of experience which other farmers have written for the improvement of all. Let him delve a little deeper and search into the science of the growth of plants. Let him secure some of the best papers and periodicals, which will keep him informed of events as they transpire about him. Ltt him read his national history, and turn a thought also to what has been done in other lands. But facts alone do not solve every problem and do not accomplish the full result aimed at. The great aim in acquiring knowledge should be the mental power it develops. So these facts must be grouped together before the relation of cause and effect is seen and general laws and principles can be deduced. This demands thought and reflection, and these bring contentment and happiness and growth to the mind itself.

The young man works upon the farm with greater zest when he can see in the furrow turned something to incite thought; when in the feeding of the stock he can see that the plan he has found discussed is proving an advantage and yielding a handsome profit; when by comparison he can see that the blade of grass or the first shoot of the shrub have come up by the same law of growth, while one comes to maturity in a brief time and has a comparatively ephemeral existence, but the other grows into a large and stately tree, and lives for generations and even centuries.

In addition to this mental acquisition of facts and principles come the amenities of life. The young gentleman and young lady on the farm are just as sensitive to the lack of culture and refinement as he would be who is recognized as extremely elegant and polished in his manners. Is it not a fact that many a young man is led to leave the farm and go to the city for fear that he shall become a boor in society, or because of false notions of gentility? Are there not many who would willingly remain on the farm if they knew that when they went into society they would not be the subject of an ungracious criticism for

every ungraceful movement, and that their presence would be welcome because of their actual worth as useful as well as ornamental members of society?

The children in the family should thus be given opportunities for improvement. Society will be elevated as the average knowledge and refinement of the family is advanced. The family represents the intelligence and virtue of the parents with any increment that may be added by outward contact with other people. The virtues of society are represented not by the highest, but by the average between the truly good and the wofully bad; and this average must be raised by the increase of the average intelligence. Here the power and influence of the parent are felt for good or ill. Here the family becomes the sacred power behind the throne which shall save or ruin the State. In this relation all classes of men—the farmer, the merchant, the lawyer, and the banker, as well as the minister—should feel that they are called upon to exert the best and noblest influences. Then will this uneasy, discontented spirit, caused by a desire to acquire knowledge and refinement, be satisfied; and the young man and young woman will remain on the farm contented because they know they are met in the spirit of true appreciation by all people.

It is a very natural and easy transposition to speak of the farmer's duty to his family, and then of his duty to the State. As the families of the State are governed, so will society itself be restrained. In like manner will the laws of the State bear the impress of the training which has been received at home. Society weakens as knowledge and morality lose their hold upon the individual affections of the masses.

In this nation it rests with the intelligent, moral, and conscientious class of society to carry forward and perfect the work of civilization. Demagogues do not attempt to mislead this class. They appeal always to ignorance or some prejudice. They get hold of the weak point of a man's mind, and dwarf his judgment by encouraging his illusions. Without moral principle or unflinching integrity themselves, they care not whether they be consistent in their views before their fellow men.

It is plain, then, that one duty the farmer owes society is that he shall heartily help to sustain the very means which this nation has adopted to dispel ignorance and disseminate knowledge,—the Common School. I believe I speak understandingly when I affirm that people generally,—and farmers are no exception to the rule,—act more stingily, and pay more grudgingly for educating their children than for any other investment they make. They will lay out hundreds and thousands of dollars in stock and outside improvements, hoping thereby to realize some profit; but when it comes to building a commodious and suitable school-house, or the employment of a competent teacher, they will cast their eyes around to see if in some corner they cannot lop off this and that convenience, or if it be not possible to get a teacher with a good deal less learning and ability for a little less money. They do not see any return in money on the investment. It may be that they never will; but most often those lessons and experiences in this world are most valuable to us which pecuniarily yield the least returns. Notwithstanding this, in proportion to the amount of knowledge and skill we furnish the young by training, we increase their power to properly use whatever they may acquire, and add to their influence for good and their usefulness in society.

If there is any question in which we should take an interest, it is this. The capacity of the common schools to impart instruction should be increased. The best qualified teachers are none too good for our district schools. We want

better educated, better drilled teachers. This is not all. There should be system in our common schools. Now everything is taught from A B C to intricate problems in algebra, and one teacher is expected to do it all. Goldsmith's school-master is yet to be found in every district school in this broad land. There should be a division of labor. When a scholar has acquired a careful knowledge of the most common branches let him pass out from that school to another where the higher branches are successfully taught. Farmers, do not keep your children all their lives in the district school at home. Let them get out and come in contact with other and more superior advantages. Let them look out beyond the narrow bounds of two miles square and gather knowledge elsewhere by coming in contact with different minds.

The common schools are the bulwark of American freedom. They are the only thing, under God, which shall save the nation from final weakness and decay. We glory in the school system of Michigan, and justly. But let us remember we have only laid the foundation. We must go on to perfect it by increasing its efficiency and thoroughness. We are doing enough work; let us now try to do better work. Do not crowd the mind, but see that the schools teach thoroughly and that the scholar *understands* the little rather than *guesses* at a great deal.

No duty should be so pleasant as that which provides for the education of all our people, of whatever class and condition in life. And if we neglect it we ruin our prospects for national growth and permanency.

Every person in this broad land should fit himself for citizenship. This is the highest aim we can set for ourselves with a sure prospect of attaining it. Intelligent citizenship is the best and closest relationship we can sustain to our nation. It is the voice of public opinion which restrains and controls those in power. They fear it. It is more potent than the cannon ball. It will cause the tyrant on his throne to tremble. It has overthrown many a ruler whose stubbornness had caused him to resist it.

How important that we should be prepared as citizens to consider the tendency of every great national question—such, for instance, as that of the currency. How important is it that our minds should be so trained that we can divest ourselves sufficiently of all feeling and prejudice, and decide such propositions upon their merits and the facts in the case. Did you ever in a time of political excitement take up a question like this of the currency, provide yourselves with the material, and then study it out, following it into all its ramifications, considering its effect upon society outside of any personal convenience, or otherwise, it may present to yourself? And yet this is the way we are to attain the full measure of our power and influence as citizens. Too many people slide over the consideration of these questions. They get in the wake of some person who is supposed to be popular enough to ride into power without considering whether the propositions he enunciates are true and deserve their support. We must drift away from this blind tendency to hero-worship. Follow a leader by all means, because in all countries some one must be set upon the watch-towers to guard and sound the alarm; but follow him because the truth he presents is just what is needed for the growing prosperity of the country. Do not yield to him, however, because you have always placed confidence in him. Examine the foundations of the political faith he presents for your consideration; and if, upon careful study and meditation, it meets with your approval, then close around your leader as the representative of the truth you profess. But if it be false, then do not hesitate to rally around another, or, it may be,

stand forth yourself as the representative of the principle you would see victorious. It is this independence of thought which we need in this country; but it should be thought and not the guidance of mere prejudice or spite. Why, a man once told me that he voted contrary to his own convictions because I publicly misinterpreted a remark he had made. I did not intend to misinterpret his position; but so bitter did he feel toward me that he would not vote for the change I was advocating, although he believed it would be for the better. This man was not doing justice to his own better nature. Neither does any man who, out of personal ill-feeling, allows himself to forget the truth and desert the cause he knows to be right. These petty jealousies and animosities are ofttimes the cause of much bad legislation, when men should rather rise above these into the realm of a true statesmanship and do valiantly for their country and for society what their own intelligence and reason, guided by an enlightened conscience, tell them to be right.

Intelligent citizenship! It means vastly more than the average of the world's intelligence. Shall we exercise it? Let every farmer feel the real burden of this responsibility resting upon his shoulders. Let him attend the political meetings of his party to see that demagogues and political shysters do not control the nominations or secure the delegates that make them. This is a duty every man owes, not merely to his party, but to society. The State and country will be better off when we drive from their places of honor and trust all who are dishonest; all who are prostituting their position to their own aggrandizement; all who seek blind partizan ends first, and place their country's second. "Let no guilty man escape." When the arm of justice falls, let us see the vacant places filled with men of known integrity, wisdom, and patriotism.

Have I placed the standard of the farmer's duty so high that he cannot attain unto it? Not at all. We must reach it, if we expect this nation to be grandly successful in the work of social progress we believe she has marked out. The farmer *can* attain unto it. It should be his ambition to reach the highest point of excellence. The young men will gravitate toward the farm if they can feel that the avenues to honor and social distinction are alike open to them. There is nothing in the business of the merchant that entitles him to greater respect than the farmer. If this difference do exist, it is because the farmers have lost their first estate, or have sat down in supineness and allowed others to ride over them rough-shod,—sat down, like some pardoned criminal, not daring to even hope for favor or consideration. The fault is the farmer's. The pathway is open. He must rise to the dignity of his own calling,—brush away the scales from before his own eyes. To assert one's right is half the battle.

Let us give every thought and purpose to the noble work of improving and elevating ourselves, and then to training those whom God has committed to our care. Educate them for the responsible duties of life. Teach them to concentrate their greatest strength upon their business, that they may become the best, most intelligent, and successful farmers. Then let them feel the importance of American citizenship, and farming will be honored and the country made better, because the average of American intelligence has been raised.

FRIDAY EVENING.

The closing session of this Institute was devoted to an address by Mr. R. G. Baird, Secretary of the State Board of Agriculture, on "The Prospective Benefits of the Centennial Exhibition."

Mr. Luce.—We have now gone through with the entire programme of exercises prepared for this institute, and as some of the ladies and gentlemen have been present every moment of the sessions, I suppose it about time that you were discharged from duty.

President Abbot.—I should be sorry to have this convention of farmers, who have come here to meet us, go away without having an opportunity to give expression to the feeling and thought we have in regard to this institute. I am very glad to be able to say, that representing the State board of agriculture who sent us here, it will be our pleasing duty to take back with us a most favorable account of our reception here, and of the pleasure that we, through the college, have enjoyed in being with you. We feel greatly encouraged by the interest felt in these institutes, and we shall go back to our work feeling that we and the farmers pull together.

On motion of N. McKnight, a vote of thanks was unanimously tendered to the professors of the college for their services, and after the chairman, on behalf of the county agricultural society, through whose efforts this institute had been secured, had thanked the citizens of Coldwater for their generous hospitality, the institute adjourned.

ADDRESSES AND DISCUSSIONS.*

THE PREJUDICE AGAINST INDUSTRIAL SCHOOLS. AN ADDRESS DELIVERED AT THE FARMERS' INSTITUTE AT ARMADA, ROCHESTER, AND COLDWATER, MICHIGAN.

BY PRESIDENT ABBOT OF THE STATE AGRICULTURAL COLLEGE.

A few winters ago I met in Washington a very pleasant and intelligent gentleman, who from his large wealth was about to give some sixty or seventy thousand dollars for the advancement of higher education. He had been for some years, and was still, the president of a State Agricultural Society, and was commissioned by the Governor, under a State law, with almost despotic power over cattle suspected of a prevalent disease. These were evidences of the high esteem in which he was held.

He was a farmer. Did he then endow some chair of agriculture, or agricultural chemistry, of veterinary science, of horticulture, zoölogy, or entomology, in some institution? Did he fit out an experiment station, like some of those in Germany, to analyze fertilizers, to study the fattening properties of different kinds of food, and their digestibility, or to study any other of the perplexing problems which his own business could have suggested to him? Did he exemplify on some farm the effects of high culture, like Mechi, or of thorough drainage, or in some such way make the lessons of an advanced agriculture visible to less informed farmers? Did he help along an agricultural college, or establish an agricultural library?

*These addresses were delivered at more than one of the regular Institutes, and are referred to the preceding reports.

None of these. He found the science that was the most advanced of any, the one that government supports at a great annual tax upon the people, and nobody complains,—the science that had last year (1874) an additional sum of $150,000 from the public treasury and the command of our navy; ignoring the struggling endeavors of agriculture to become a science, this farmer gave his thousands to endow another workshop of astronomy.

He is no sinner above the the rest of us. We are willing to be fed by agriculture, and clothed by practical machinery, but if these and kindred industrial arts claim any place beside the Greek and Latin, mathematics and its applications, especially astronomy, beside metaphysics, law, medicine, theology, literature, they are frowned away because of their working-day clothes.

SUPREMACY OF THE CLASSICS.

A course of study made up mostly of Greek, Latin, and mathematics and its applications, and philosophy, usually goes by the name of the classical course. Until a recent period no course of study, however thorough and protracted, was supposed to give that discipline of mind, that culture, that acquaintance with what a scholar should know, that would entitle one to be called educated. This term, educated, had a technical and limited, and as I believe far too narrow an application. The prejudice is by no means gone by, but to a great degree domineers over both the educated and the unlearned people of this day. But the educational problem has broken out afresh, and this time it is the battle of the classics and the sciences.

STATEMENT OF THE CASE.

While the sciences, other than the application of mathematics, have been of immense importance in modern life, they have been slow in fighting their way into modern courses of study. "Ten years ago," says Nature, a London weekly scientific journal of the highest authority, in its volume for 1869, vol. 1, p. 25: "Rugby was the only public school that taught science at all. No school was assigned to it. It was an extra, and heavily weighted by extra payment." The great universities, rich in their rewards to those who came from the schools with high scholarship, ignored profficiency in sciences almost altogether; so the whole influence of social standing and great wealth were on the side of the classics. This is still so, to a great, a very great, extent. The schools and universities, backed by the customs of a long past and the prejudices of the day wait for a miracle to set things right. They say they wait for each other. The schools say they must prepare scholars for what will take the prizes; the universities, that they must give their rewards to those who are properly qualified. The slow workings of public opinion will in time, however, call Cinderella from beside the ashes to her proper place, the equal of her sisters.

American colleges copied the English. They were designed chiefly to educate clergymen. I hold in my hand a Yale College catalogue for 1841–2. There was then no scientific school at Yale. The catalogue speaks of certain limited courses of lectures in the natural sciences, delivered to different classes, but if we look to the one course of study which all students were obliged to pursue, we find in that no chemistry, no botany, no zoölogy, no geology, nor anatomy, physiology, mineralogy, meteorology. It is all Greek, Latin, mathematics and its applications, philosophy, logic, and the like. The man who graduated then, however ignorant of his bodily system, of the earth and its productions, was educated.

When, at a later date, scientific courses were adopted, they were put on an inferior footing, and inductive sciences were admitted unwillingly to any fair share of attention.

Examples could be multiplied extensively to show the grudging way the claims of science were admitted, and the inferior discipline that was required of students of scientific courses, while on the other hand these students were expected to sustain themselves as against others who had received three more years of instruction in the schools.

In more recent years a great change has been made in the courses of study that colleges present to the choice of students. Harvard and Yale, and a large number of colleges have their scientific schools and courses. As yet, however, the scientific courses are held in inferior estimation. In most institutions this lower rank is forced upon the course by its inferior standard for admission. The University of Michigan, always in the advance guard of progress in educational matters, is one of the very few, if not the only one that has put scientific and classical education on an equality of rank, and the prejudice that still lingers against the scientific courses as inferior, will soon die out when the preparatory schools that feed the University begin to take a like pride in fitting for the scientific courses that they do for the classical ones, and when the college students in the sciences exhibit a like discipline and power with the others.

IN PART JUST.

A part of this predilection for the classics is just. Our civilization, our literary culture, our philosophy comes so largely from the Latin and Greek that no other ancient languages and literature can compare with them in interest and usefulness to us. The Grecian models are in their limited way so faultless that they delight and instruct us. Nor as fountains of knowledge are they by any means exhausted. When we thought we knew Athenian history aright, and that it warned us against democracy, then there comes a Grote, who, reading the same old Greek books under the influences of a new age, and with the experience of a statesman, shows us how this same history tells for republican institutions and freedom. Classical courses besides have been found efficient means of education in the past. It is the meat on which the statesmen, lawyers, theologians and scholars of the past have been fed.

IN PART HISTORICAL.

In part this predominance of classical studies is an inheritance from times so unlike ours, that the reasons for it no longer exist. In the Dark Ages people did not read. Turn to Hallam for the picture of the dense darkness of the times. According to Pauli, in his life of King Alfred, judges could not read the laws they administered. The revival of learning, and the taking of Constantinople by the Turks, filled Europe with scholars and with books. In what languages should they read and study? In Latin and Greek, for there were no other. In what should they write? In Latin; for English, German, and French were then unshaped, or at least thought to be narrow and unsettled. Latin became the language of scholars; and so late is the sway of this language, that Bacon wrote his Philosophy, Newton his Principia, Milton the Republic's official letters, and Berkley his Theory of Vision in it. It still lingers in Triennial catalogues and commencement addresses. Formerly these ancient languages were essential to the educated man, for without them literature, science, and professional knowledge were not to be had. It is so no longer. German

and French will open more treasures of learning than all the languages the earth possessed fifty years ago. The English alone will do it. If Latin and Greek still deserve the predominance they possessed it must be on new grounds, and the fact that what was best educationally in former times is still so in changed conditions, if it be a fact, is, as Goldwin Smith has pointed out, a simple, although remarkable coincidence.

The Greek and Latin books that furnished all the matter of education in old times had much to do with the relative esteem in which science and literature were held. What could the scholars of those times read? Certainly what the classics contained, not what they did not afford. These books contained treasures of history and poetry; they discoursed of rhetoric, politics, morals, philosophy, and art. They had comparatively little of science, and almost nothing of the practical affairs of life. The curious may see this matter clearly set forth in John Mason Good's Book of Nature, Series 2, Lecture eleven. Aristotle, translated from the Arabic, introduced the scholastic philosophy; Greek and Latin brought metaphysics, literature and languages to the schools, and poetry, painting, and sculpture became the pride of courts; but science, and even mathematics, languished. When Oxford had thirty thousand students, and Paris still more, Roger Bacon could find but two good mathematicians in the world.

Craik (English Literature, Vol. 1), says metaphysics and logic, together with divinity,—which was converted into little else than a subject of metaphysical and logical contention,—so occupied the crowd of intellectual inquirers, that except the professional branches of law and medicine, scarcely any other studies were attended to. Down from times when this was a true picture of its educated men, our universities and colleges have come impressed with no inconsiderable portion, so to speak, of the old neglect of natural science. Great schools are conservative, and with a haughty disdain of learning not imparted by themselves, they adhere to their first definition of learning, and the veneration every man pays to the institution where he took his degree, helps to preserve the notion that there is but one way to the ranks of the educated and that is by the beaten track of a collegiate course of Latin, Greek, and philosophy. It is an old saying that possession is nine points of the law.

DISCIPLINE.

It is said that scientific studies do not discipline the mind. Sir William Hamilton thinks the physical sciences are good for those dull alumni who are incapable of thought.—(Discussions, Harper's Ed., p. 705.) He and such as he know the educating effects of the studies they have themselves pursued, but do not know the value of studies into the spirit of which they have not entered. All things seem easy to him who has not tried them, and every youth would drive the chariot of the sun if he could. Science seems a mere committing of facts from a book,—that is the idea these scholars have of it. Dr. Wayland, formerly of Kalamazoo, overheard a graduate expressing regret that he had had but four weeks' study of geology. He heard his classical friend, an able and well informed man, reply, "Well, I presume that in that time you learned all that is to be known about geology."

An able educator once passed with me an hour in a class in zoölogy, and on leaving remarked, "Do you call that education? I," he said "certainly do not." It seemed to him a tax on the memory alone. There is a way, of course, to make any study a process of memorizing. It is not confined to natural history. Carlyle thus thunders his condemnation of the routine study of

the languages, in his Sarter Regartus. "My teachers," said he, "were hide-bound pedants, without knowl_dge of man's nature or of boys'; or of aught save their lexicons and their account books. Innumerable dead vocables they crammed into us, and called it fostering the growth of mind. How can an inanimate, mechanical gerund-grinder foster the growth of anything: much more of mind, which grows, not like a vegetable (by having its roots littered with etymological compost), but like a spirit, by mysterious contact with spirit; thought kindling itself at the fire of living thought. * * The Hinterschlag professors knew syntax enough, and of human soul thus much: that it had a faculty called memory, and could be acted on through the muscular integuments by appliance of birch root."—Pedagogy, p. 84. Or come down to this very winter of 1875–6, when the distinguished professor of Greek in Edinburgh complains of the great University of Oxford that "a great deal of harm is done to young men, who are merely drilled like a parcel of old Prussian pipe-clay sergeants."—Weekly Scotsman, Nov. 20, 1875, p. 6.

Of course, when the methods used in the languages rule in the study of science the results are not satisfactory. "This, therefore," said Bacon, "is the first distemper of learning, when men study words and not matter." Science, to be disciplinary, has its own methods. Properly pursued, they have probably no superiors in the development of the perceptive and discriminative faculties, of the judgment, the imagination, and the power of generalization. Their influence over the moral emotions is profound and healthy. The subject has received so much discussion of late years that I forbear to enter it farther at this time.

A CONTRAST.

Here, then, is a man who has been classically educated. He expatiates free o'er all this scene of man. He understands the languages in which the literature of the world is written. He writes histories, guides thought on many subjects. Shall we not call him learned? The world does so and justly. And yet perhaps nature seals from his eyes its mysteries. He knows no chemistry, nor botany, nor geology. The enlargement of the sun as it rises in the east, the shifting colors and scenes of animal and vegetable life are outside of his thoughts and knowledge. Learned and cultured as he is, it is after all in a confined sphere of thought and enjoyment. He goes to spend his vacation at the sea side. What takes he for his thoughts and study? a pocket volume of the Greek poet Euripides, and writes us the thoughts that arise as he reads, in prose so beautiful that we are constrained to read, and to look again at the Grecian tragedies in his guidance. Froude may know more science than I credit him with. I make his name stand only to represent the kind of culture which many have who are called cultured and learned.

Here is another. He walks the sea shore in his vacation, and a piece of chalk at his feet awakens a train of thought that goes back to centuries before Homer wrote, recalls to his mind the action of forces which in their wild, and varied, and yet law-abiding action, have made the world what it is to-day; not a motion of cloud or condition of the air, but recalls the results of the investigations of hundreds of observing and of comparing students, who have, besides, supplied from deeper sources within themselves, through the exercise of high powers of insight, the key by which nature's workings are entered into and comprehended. He needs no book. Like Shakspeare's Jaques he finds

> "Tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything."

But his thoughts are not rambling. The sciences he has studied have method in them. Their principles are not made up, but discovered; and although hidden at first, and the reward of laborious research, are when found usually simple, always sublime, and far reaching in their relationships. He feels as he looks through this book of nature that he is reading the very thoughts of God.

He knows English, and German, and French—and they have brought to his use the observations, the speculations of the foremost philosophers of our time. They serve him, too, to express in clear terms facts, theories, and principles. Should he be found ignorant of Greek and Latin will you term him uneducated?

The truth is, he who has not had physical sciences in his course of study lacks a kind of discipline that is very important. The problem of reducing the process of induction to the form of an aristotelian syllogism is yet unsolved, The power of learning directly from nature herself, of observing, comparing, and making an induction cannot be learned by any use of books. A little geology here and a little physiology there in a classical course, cannot serve the uses of science as an educating power. Courses of study must be lengthened, or some students must be allowed to choose the sciences to the neglect, say, of Greek and Latin, and credit must be given for its equal educational power. Classical courses usually contain astronomy, whose higher use, educationally, is in a certain discipline of the imagination, the imparting of a power to hold steadily in mind circles great and small cutting the sky, while we reason on the relation of their parts and movements. The physical sciences make a constant demand on this kind of imagination. Some of the subjects of physics—like polarity—cannot be comprehended without this discipline. The same is true of the classificatory sciences when carried beyond the rudiments. Properly pursued, a term's study of science ought to be worth as much educationally, as a term of Greek.

BREAD-AND-BUTTER SCHOOLS.

Industrial schools have been looked down upon, as of a grade altogether inferior to those of a literary, classical, or philosophical kind. They have been considered as in some sort bread-and-butter schools, whose highest aim was to clothe and feed this miserable body, while literature and science were wont to strike their sublime heads against the stars.

Let us look a little into this matter of dignity. I freely admit that the educated man finds, or ought to find, in his studies a happiness superior to that of mere bodily comfort and enjoyment. These are not to be despised, but above them are the needs of our intellectual, moral, and æsthetic natures. I spent part of my youth in most intimate association with young men, several of whom now hold high positions in schools of theology, science, and literature, and I know they enjoyed a good dinner as became them. But their delight was in the dramas of Sophocles, and other masterpieces of literature and philosophy. They would have thought themselves insulted by the insinuation that they sought truth but for truth's sake, or felt otherwise than that beauty is its own excuse for being. I believe this is the true spirit of the scholar, even in this working world. The dignity of philosophy, of literature, of history, I do not deny. What I claim is that these have no monopoly of this true spirit. Pure mathematics and astronomy, indeed, have been long admitted into the select company. Plato was a geometer, and made his science religious by saying God himself geometrizes.

But the same spirit that makes philosophy food for the soul may and does

make all other studies a like food. It is not the bread that nourishes, but the blessing. It is not the text-book, but the man that determines the result of intellectual digestion. Philosophy, even theology, may be pursued in a sordid spirit, while pomology, zoölogy may receive the purest devotion to truth.

I walked over acres of ripening peaches with its proprietor. Peaches were made to eat. He knew the delicate flavor of his George the Fourth or his Douay, but he seldom tasted a peach,—they had become common to him. Peaches are made to sell. He understood his Hales, Crawfords, and Barnards. But over and above all this he had other delights. In work well done; in cultivation that kept his grounds clean of weeds, in having his labor performed up to the very requirement of his needs, in the success attending his efforts, there was the gratification of much higher than mercenary desires. He enjoyed the deliciousness of taste more in an æsthetic than in a sensuous way, and yet the enjoyment was real. He saw beauty in form, in color, in fragrance in bloom, in rows of well-formed trees, and delighted in that beauty; and why should you say that this appreciation of beauty is not as pure and ennobling as in looking at a landscape painting of Cole, Turner, or Troyon?

I walked about the farm and barns of a successful farmer in Oakland county. As he showed me the barns he had planned with manifold peculiar conveniences, the well cleared fields and farm roads, all of which had come from out a dense forest, the product of labor, to be sure, but of labor joined with thought, and with the creation and upholding of an ideal, I could see that the ideal, and the partial success he had had in attaining it, were a much larger portion of his daily enjoyment than was the competence he had acquired. Of course the competence, the success, gave free scope to this higher enjoyment. That, indeed, is the best use of material success.

The best promise of improved machinery is that it shall save time and strength that may be used to develop an interior excellence and enjoyment. If education and machinery will feed and clothe me in one half the time that was required without them, I have so much more time and strength for the achievement of further success. So of the nation, provided always that moral development keep pace with physical; for otherwise time means drunkenness and rowdyism. Nothing is of more importance, therefore, than that that education which can give employment to thought, to imagination, to taste, should keep pace with physical developments in a nation. In truth, sad to say, it always lags far behind.

But to return. These higher enjoyments are no exclusive prerogative of any class. The pomologist, the wheat-grower, the stock-breeder in the midst of his straight-back cattle, the machinist, the architect, are endowed with the same truth-loving, beauty-seeing nature as the architect, the landscape gardener, and the poet.

And this nature finds play in a scientific course of study. The unity in variety that appears in the vegetable world; the development of a few primordial forms into all the infinite diversity of shrub and tree and lesser plants; the plan of structure revealed in their comparison and classification; the laws of growth, fructification, and dissemination,—these intellectual parts are still more wonderful than what appears to the eye, beautiful as may be the blossoms of trees and flowering shrubs, or grand as are the monarchs of Mariposa.

As for study for its own sake, surely literature can show no more disinterested zeal than science in any of its departments. See Agassiz having, in his own words, "no time to waste in making money." See Faraday casting aside the

certainties of wealth as a practical chemist for the external poverty and rich internal wealth of a life devoted to the discovery of truths of science. See Linnæus, who seemed to care for nothing but his favorite science. See anywhere in the biography of scientific men a devotion to science as strong as ever bound a miser or inspired a poet. The same kind of enthusiasm, which in one place I have seen kindled by Greek literature, I have seen in another bestowed upon anatomy, or zoölogy, or geology, or botany, or chemistry. It doesn't hurt these studies that they are useful. We are not quite to the day, but we are approaching it, when men will not apologize for being useful. And now the whole division between useful and useless needs revision. If music cultivates the taste, bestows a refined pleasure, it is in its high way as useful as that which adds an increase of flavor to the peach or grape, for the less refined pleasure of the tongue. If Greek seems remote from our modern needs, it is only our ignorance of its relations thereto. I find, indeed, on turning to a work entitled "Classical Study, its value illustrated by extracts from the writings of eminent scholars," edited by Dr. Taylor of Philip Academy, that no argument for the study of Greek and Latin is oftener urged than their usefulness. Yet the book was purposely made to combat the aggressions of a scientific upon the classical courses of study. In my library there stands, peacefully unconscious of inner repulsion, a book compiled by Mr. Youmans, entitled "The Culture Demanded by Modern Life." Its purpose is to recommend the study of science, and yet its pages are full of arguments drawn from the dignity of these objects of study, the true discipline the study affords, the deep pleasure it bestows. No one can say abstractly whether Greek or chemistry will be of the most use to a young man just entering upon a course of study, nor is there any reason why those who are in one course should look down in the least upon those in any other. Nor does one course any more than another overlook the true disciplinary ends of study.

The motives that operate to keep a person to a course of study are seldom simple and one. They are oftener mixed and of variable strength. The expectation of greater power through the two endowments of study, that is, through mental discipline, and through knowledge, is one strong element in probably the larger part of a body of students, and it is as honorable in the chemical laboratory, or the agricultural school, as it is in him who takes a literary and classical course that he may be the better speaker or writer. One studies to be a more successful practitioner, another to be a better engineer or farmer; where is the odds as regards the dignity of the motive? Then there is the sense of the dignity of our nature, and its obligation to *know*, and to develop within itself beauty and power. There is the native curiosity of man out of which comes philosophy and science, and which craves satisfaction in the pursuit of truth, as much as taste and imagination seek it in poems and marble. There is the desire to be useful, to forward society in its comforts, in the dignity of its employments, in its higher welfare. All these impulses find a fitting preparation in different lines of study, with some in classical studies, in a larger number in a knowledge of spoken languages and of the sciences. The proper ground it seems to me was taken by the eminent founder of Cornell University in his desire to spread his table with the elements of all knowledge, and then to count none of them common or unclean. There is no study which cannot be narrowing if studied in a narrow spirit, none without such relationships as make it ennobling. To the lean mind the highest truths of theology remain thin. Like the lean kine of the Nile, the mere knowing faculties may feed upon the fat

kine, and never be the fuller. But to the generous mind all knowledge is sacred, and so connected with other knowledge as virtually to be a center of all truth. A Goethe can say of so meager a thing as book-keeping by double entry, that "it is amongst the finest inventions of the human mind."* To learn all truth you may begin anywhere, and with any one. "All the arts" says Cicero, "which pertain to humanity have a common bond, and are united to each other in close relationship."†

To do away with the prejudices against scientific courses, it will be necessary in the first place to put them on a par with the classical courses in the same institution so far as amount of previous preparation is concerned. Four years course with almost no previous preparation can never be equivalent to a four years course preceded by three years of preparatory study. The tables would be turned, if the conditions were exchanged.

Again the sciences must be taught in a way to make their study truly disciplinary. It is an advantage of ancient languages that they cannot be learned by the memory alone. Geometry may be learned by heart, the construing of Virgil cannot. The charge of teaching the sciences must be committed to those who are enthusiastic students and investigators, who will take their pupils into their own ardor, and make them learn directly from nature, not of course, one out of a thousand of the facts of science, but enough to understand the processes of investigation and principles of classification.

Again, the students of science must have some general acquaintance with the affairs of men, and especially must be able to use language well. It is a mistaken economy of time that finds no place for long continued drill in the use of language. Critical reading of standard authors, exercises in the statement of facts, in arrangement of matter, in condensation, illustration, should be insisted upon in scientific schools. Besides the uses of language in communicating ideas, it has an educational one that ought not to be overlooked. Clearness of expression, and clearness of thinking usually go together. The attempt to put into language what we know makes that knowledge more definite, sifts out the vague elements that we thought were clear until we attempted to give them expression. Thought and expression have a reflex influence on each other.

There is a prejudice against schools of science on the part also of those who think the practical results of an education should be more direct and marked. Men dislike a roundabout way to their purposes even though it be the surest in the end. Teach us the art, the practice at all events, and let principles take care of themselves, they say. I said to a lawyer of a growing practice in one of our cities, you took a course in a law school. Yes, he replied, but I would not do it again, had I my law education to seek. It is a long way into the practice and those who passed into the business through the simple training of a law office find themselves ahead. A professor of chemistry, a friend of mine, visited a soda factory in the west and was received by the proprietor with the announcement that chemists were of no use to the world.

But scientific schools are founded on the principle of faith in the utility of science. Nothing is more useful than pure science. No one knows where it will reveal its utility. Because Galvani played with the leg of a frog we have the electric telegraph, and because others have watched the sands upon a plate above sounding strings we can send music from Detroit to Chicago, and are like to be able to send several messages at once over the same wire. Hooke was

*Meister's Apprenticeship.
†Pro Archia.

ridiculed for his 'swing-swangs,' but the pendulum clock is the result of his experiments. It is to persons deeply versed in the principles of things that we owe our great inventions. Lawyer Tull, returning to England after travel for his health invents the seed drill, and when its introducer into the United States wished to simplify it he applied to the president of Yale college whose mathematical genius sufficed for the task. Rev. Patrick Bell invented the mower, Whitney, a college graduate the cotton gin, and so on through a large part of the catalogue of inventions. But it is no part of my purpose to vindicate the practical nature of science. "To a sound mind," says Emerson, "the most abstract truth is the most practical."

SCIENCE IN THE COURSE OF STUDY.

What should the schools do? Some are disposed to say, Give us practical manual training first, then, if time admits, go deeper. But the general opinion of educators is, give us the underlying principles thoroughly, and skill will add itself to knowledge with great rapidity. The accomplished mariner, engineer, builder, know the principles of their business. Difficulties that are insurmountable to the man of mere practice, give way readily to the man who joins a knowledge of principles to his practical skill. Burke pointed out, in his delineation of the character of Lord Grenville, the helplessness of a man of mere office training, in the perplexing circumstances where no precedents exist for him to follow.

You will find, then, in the catalogues of almost all schools of engineering, mining, and the like, full courses in the sciences on which the arts depend, and an introduction into the French and German, in which languages a large proportion of our best scientific works are written.

"All the polytechnic schools in Germany are rapidly approaching the university type. The teaching of the principles, and not the application, is becoming more and more the main object."* Prof. Hilgard, formerly of the Michigan, now of California University, speaking of agricultural schools, says, the "model farm system on the old plan is rapidly giving way everywhere before that system which, while affording abundant opportunity to the student to become an expert in all kinds of agricultural operations, directs his attention chiefly to the *principles* upon which a successful practice must be based, and which are applicable everywhere and always."—Address on Progressive Agriculture, p. 30. The Carlsruhe Agricultural School, one of the most prosperous and useful in Europe, has among its regulations, posted in large type, the announcement, "This school is concerned with the cultivation of the mind of the student; not with learning the technical operations of agriculture." †

Liebig says, "I have found, in all those attending my laboratory who intended to pursue a technical course of study, a general predisposition to devote themselves to some branch of applied chemistry. It is only with feelings of fear and trepidation that they consent to follow my advice, and give up the time they thus waste on mere drudgery to making themselves acquainted with the methods by which pure scientific problems are soluble, and by which alone they can be solved. There are many of my pupils now at the head of many departments of manufacturing industry, who, having had no previous acquaintance with the processes, were in half an hour perfectly *au fait* with all the details of the man-

* Nature, Vol. 2, p. 42, 1870 (leader).
† Nature, Vol. 1, p. 476.

ufacture, while in a short time they saw and introduced all kinds of necessary reforms and improvements."

By means of the international exhibition of 1851 in London, and 1867 in Paris, Great Britain perceived that she was being outstripped in the quality of the fabrics and wares on which her wealth so largely depended. She appointed a commission, she interrogated her consuls, a council of arts sent eighty skilled workmen, representing many industries, to France. But one answer came back from every quarter,—that the rapid progress of manufactures on the continent is to be "ascribed, especially, to the scientific training of the proprietors and managers of France, Switzerland, Germany and Belgium, and to the elementary instruction which is universal among the working population of Germany and Switzerland." England is already reaping the results of the education of her artisans, which this investigation prompted.

It might at first view seem hopeless to attempt the improvement of great masses of workmen by means of schools, inasmuch as comparatively few can attend. But experience proves it feasible, as I have just shown. Knowledge is like light, and diffuses itself on every side.

The profound thinkers that are essential to the highest progress of any science are rare, but they appear oftenest in those callings that have a large body of educated men, and this body of educated men require the existence of industrial schools, where the teaching of the sciences shall not be put on a footing inferior to the practical training. It has not been my purpose to mark out the organization of industrial schools but simply to discuss the estimation in which they are held. As in the first part of the address, I showed the feeling that has existed against them partly with and partly without reason, on the part of classically educated men, so now I have attempted to deal with the feeling that merely practical men have against them from the prominence they give to pure science. Those who ask these schools, agricultural, professional, or technological, to teach only practice, and applications of science ask them to fly in the face of the experience of all industrial schools and to deny the large faith they have in science.

DISCUSSION AT COLDWATER.

Cyrus G. Luce.—The programme announces a discussion on the Agricultural College, and that I am to follow President Abbot. This discussion was intended more particularly to call out information in relation to the college than to criticize or condemn it; and each speaker will be restricted to ten minutes as a sufficient time in which to express his views. I wish to say right here, that in many of the things uttered by President Abbot I most heartily concur. No man believes more firmly than I that a good education, combined with experience, is demanded to successfully prosecute the duties of the farm. The farmer must have a knowledge of a greater variety of things than men engaged in other callings; and I rejoice to know that so large a percentage of the students of the Agricultural College are giving dignity to the labors of the farm. I rejoice in the fact that the ideas of conducting the State Agricultural College have been for years gradually approximating the views held by a large proportion of the farmers of the State.

I was more particularly acquainted with the manner of conducting the college ten or twelve years ago than I am now, and still, from what I can learn, I think it might be made of greater benefit to the farmers. I think there is too much time spent over things which are taught in our union schools,—which our young

men can get in Hillsdale College, the University, and many other institutions of learning. I have always desired a college reaching out in its benefits to the farmers of the State, believing that an institution of this kind should be conducted to that one end. Very few of us farm for fun, but for the profit we expect to realize from our labor; though I am sorry to say that many are compelled, at the end of the year, to part with their last dollar to meet the assessments made upon them.

My idea is that an agricultural college should be something that will reach out and help all of us; or one great, grand experimental farm, under the management of the best talent the State can procure. Such an institution should be made more practical and not so scientific. I do not wish to be understood as attacking science, but let us feel the benefits of its results in our business. I would not remove the Agricultural College, and I do not believe it ought to be attached to any other institution; but I would like to see experiments in farming made, and then the State Board should tell the people just how they were made. Such a farm should be made to pay all the expenses and more. A strict book account should be kept, just as a good farmer keeps his accounts, to see what enterprises pay and what do not. The results of these experiments should all be spread out in the annual report, so that the farmers can see and know just what has been accomplished. I believe the teachings of the Agricultural College are being turned in the right direction, and it rests with the people to make it more and more the agricultural institution of the State.

C. J. Thorpe.—I rise to present one phase of the objections which are urged against the Agricultural College, and that is, that no language aside from the English should form a part of the curriculum of that college. I have nothing to say against any language, but I believe the English language is the best language that has ever been invented. It has been my fortune to study four languages beside my own, with what profit I will not attempt to say, and I have been engaged in teaching languages more or less for the past 13 years, and I have never yet been able to satisfy myself that the time spent with foreign languages, except in exceptional cases, was really of value to the student. It makes no difference whether a student is to follow the life of a farmer or some other business, he should perfect himself in the English language, and not neglect it for something of questionable value. Some of the best writers and speakers who have appeared before the world were unacquainted with any other language but the English. Now the question arises: Is it necessary to drag into an agricultural college any other but the English language. I believe my friend Luce hit the nail on the head when he said the college should be made essentially agricultural in order to benefit the farmers. I know the college is doing a good work, and that it would be a great loss to impair its usefulness in any way, and this criticism in relation to giving prominence to French and German in an institution of this kind is done with the friendliest feeling.

President Abbot.—In the Agricultural College the sciences have displaced the Latin and Greek commonly taught in other colleges. French is taught in the Agricultural College, and I should be glad if students had the opportunity of learning the German also. Certainly the experience of other colleges ought to have its weight as against any mere theories of education. As a matter of fact nearly all industrial schools, scientific schools, and agricultural schools, require French. Indeed, one agricultural school in New England, to which some of our graduates have resorted, does not admit students who cannot read the French, into the classes of agricultural chemistry. Any scientific investigator

in the department of agriculture, or any other field, will be likely to waste valuable time and energies unless he can keep himself informed of experiments and speculations which are accessible only in these languages. The college hopes to graduate at least a few who shall further agriculture as a science. Should they leave the institution with no knowledge of any language but the English the task of learning French and German would seem to them insuperable. We so teach French that a short course enables them to read it. To show students the way into the widest and most thorough investigation is certainly a duty of the college. It is probably reasons such as these that have led to the adoption of French into all scientific schools.

In regard to experiments President Abbot said he believed the board had lately taken such action as would prove satisfactory to the friends of the college.

ADDRESS ON SWAMP MUCK.

BY R. C. KEDZIE.

Thirteen years ago when I first entered upon my labors at the State Agricultural College, a very intelligent farmer of Eaton county, then member of the Legislature, said to me, "If the Agricultural College will tell the farmers of this State what to do with their swamp muck; it will pay this State more than the College will ever cost. I believe there is untold wealth in swamp muck." These words made a deep impression on my mind, and from that day I have endeavored to do my part in answering the question, what shall the farmer do with his muck? In the Reports of the State Board from 1863 to 1868 you will find various contributions which I made on this subject.

One of the first requirements for successful farming in any country is to know what means for enriching our fields, increasing their yield, and at the same time preserving their fertility, are to be found in abundance and ready for immediate use, and how to use those means.

In former days it was the habit of ignorant scoffers to speak of "the vast and uninhabitable swamps of Michigan,—the home of malaria, and the breeding place of frogs and slimy reptiles." The drainage laws of our State have done much to remove this opprobrium by a wisely concerted system of drainage by which each tract of land thus benefited was made to bear its just proportion of the cost of this benefit. No more just or wise law was ever enacted, or one more beneficial to this State, and by it hundreds of thousands of acres have been brought under successful tillage. Nor is this all, for the benefit of the public health has a hundred times paid all its cost. But I do not appear before you to speak of the drainage and reclamation of swamp lands. This is a subjects that needs no advocate before an audience of intelligent Michigan farmers. What I have to say relates to the use of swamp muck after it has been thus drained and reclaimed.

The subject I present for your consideration is the value of swamp muck as a manure, its physical and chemical properties, and the mode of using it. I do not bring this material forward as the panacea for all the ills farmers are liable to. I do not claim that it will replace all other manures, or that it will remedy

all the physical defects of every soil; but I do claim that it will greatly increase the value of other manures, and will ameliorate the physical defects in many soils.

ORIGIN OF SWAMP MUCK.

Swamp muck is formed by the imperfect decomposition of vegetable matter. It consists of the more or less completely decomposed remains of countless generations of marshy plants, mosses, grasses and sedges, together with the materials which have been washed in, or blown in, from the surrounding land. The mosses and marshy grasses, especially when covered by stagnant water, undergo a slow and incomplete decomposition, becoming converted into a material known as peat, in Europe, and muck, in America. It is the product of cool and moist situations. In moist and cool climates the decomposition of vegetable materials is slow, while the growth of the plants furnishing this material is rapid; and hence the rapidity with which it accumulates in the British Islands and in Northern Europe, and the slowness with which it forms in our Southern States. In tropical countries, in consequence of the rapidity of decomposition of vegetable matter, no deposit of peat occurs except in cool mountainous elevations.

In countries where there is a tendency to excessive accumulation of peaty matter, and where its natural decomposition is very tardy, we find that but little importance is attached to it as a manural substance, but the effort is rather to get rid of the material altogether. Thus in Great Britain they resort to the process of "paring and burning," cutting the surface into thin slices to dry it, and then burning the dried mass and scattering the ashes on the unburned portion.

VARIETIES OF MUCK.

In consequence of the varying conditions under which this vegetable decomposition may proceed, we may find in the same bed three well marked varieties of muck: First, we find mossy materials which have undergone little change, having the original plant structure very perfectly preserved, of a brown color, and when dry very light and spongy, like compressed hay. Here is a specimen in which the mossy stems are beautifully preserved. This substance is of no value as a manure, not having reached such a stage of decomposition as to develop any valuable qualities. It might be used for mulching, or it might be burned, and the ashes used as manure. Second, we have material which has decomposed so completely that only traces of the original vegetable structure can be detected. The material is a solid, unctuous mass, which cuts like soft clay or old cheese, and I have called it cheesy muck. It is of a dark brown or black color, and usually the darker the color the better the quality, because this darker color shows that it has combined with some alkaline substance by which its quality is improved. To exhibit this change I took a lump of brown muck and divided it into two parts. One is dried in its natural state, and the other was first drenched with ammonia water and then dried. Here are specimens of both kinds, and you will observe the darker color of the ammoniated muck.

This cheesy muck is usually formed by decomposition of vegetable matter *under water*. It often has a distinctly acid reaction, and is then literally "sour muck." I show you some blue litmus paper which has been pressed on a piece of this sour muck, and the red color shows that it is acid. While in this acid condition it is unfit for use as manure. No acid soil will produce valuable crops.

Some have claimed that the acid present was oxalic, and have tried to explain why sorrel, which contains a good deal of oxalic acid, grows so readily on sour muck, "because it finds plenty of oxalic acid in the soil." Unfortunately for this argument, oxalic acid is not present in sour muck: the acid is either sulphuric in the form of sulphate of iron, or is one of the vegetable acids of muck, *e. g.*, the crenic or the apocrenic. Besides, we have no evidence that oxalic acid, if present, would promote the growth of sorrel, or any other plant that contains that acid. The acid is formed by the plant, and not derived as such from the soil.

When this cheesy muck is dried it shrinks in volume, forming a hard, coaly mass, and may remain exposed to the weather for years without much change. Here is a sample of this kind. Many farmers have complained that they have applied muck to their lands without any benefit, and sometimes with actual damage. It is probable that they have used this kind of muck.

Third. When this cheesy muck has been exposed to the air so as to be thoroughly acted on by the frost, we find a dark brown or black powdery mass, which is not to be distinguished from the vegetable matter or mould of soils. It is this powdery muck which is of so much value to the farmer, and is the only kind of muck which is fit for immediate application to the soil, or for any use except to form composts with fermentable manures or with alkaline substances. It must be borne in mind, however, that the cheesy muck, thrown on the land under such circumstances that it will be thoroughly frozen before it dries out, will thereby be changed to this powdery muck.

INFLUENCE OF FROST AND WEATHERING.

You may ask, if this powdery muck is alone fit for immediate use what shall we do with the cheesy muck which is so much more abundant, but which is unfit for use in this form? The cheesy muck is readily changed into the powdery variety, its acid properties removed and thus fitted for immediate use, by the action of frost and by exposure to the weather. Here is a specimen taken from the same lump as the hard and coaly mass I have already shown you, but which instead of being dried without weathering and freezing, was exposed to the action of the frost for three weeks. Instead of a mass of stony hardness, it is soft and powdery, and free from all acid properties. All that is necessary to change the tenacious sour muck to a useful form is to expose it thoroughly to the action of frost for one winter. But if you dig it up in the spring and throw it on your fields without freezing, very probably it will form hard clods and only be an injury to your fields. It is remarkable how little the frost penetrates into these muck beds. I have found the frost extending down in a sandy soil four feet while a muck bed was frozen only eight inches. Hence the action of the frost is confined to the surface of the muck bed under natural conditions and only a thin covering of the surface muck is fit for immediate use. It is obvious that when we throw up the muck into piles to freeze, we should not make our piles so large and compact that the frost cannot penetrate the entire mass.

Now let us look for some explanation of this singular influence of frost and weathering on this muck. The muck when first taken from the bed contains a very large percentage of water—from 60 to 85—and when this water freezes, the expansion of the water in passing into ice, splits the coherent muck into millions of particles separated from each other, and when it thaws out we find the *splitting wedge of frost* has divided the mass as no device of man could ever

accomplish. But while the frost is thus grinding it to dust, the air is also acting upon it, The muck is eagerly absorbing the ammonia of the air, neutralizing its acid properties, and when spring comes, we find its acid properties all gone. The oxygen of the air has also been at work in ripening the muck, converting the inert materials into more active forms.

I consider this action of the frost and weather as almost indispensable for the successful use of muck as a manure, and I think that the failures which have occurred in the use of this material have arisen from the want of this ameliorating action of the weather, or else from selection of the wrong kind of muck.

We may sum up the advantages of weathering muck under four heads:

1st. We get rid of a large amount of water when thrown up in piles, and thus save about one-half of the expense and labor of handling.

2d. The muck acquires ammonia from air when freely exposed to its action. It thus loses its acid properties and may become as valuable as well rotted manure so far as furnishing ammonia to the crops is concerned.

3d. The muck becomes ripened by exposure to the air: the insoluble and inert humin becoming oxidized to the more active form of humic acid.

4th. By the action of frost it becomes a soft and powdery mass like leaf mold.

Unless a farmer is going to compost his muck with fermenting manures and thus secure by active fermentation of the muck many of the changes secured by weathering, he should not fail to grind his muck with this mill of frost.

COMPOSITION OF MUCK.

Muck consists of a combustible, and an incombustible material. If we heat a quantity of muck very intensely in the air, it burns, the combustible material escapes, leaving an incombustible material or ash. This mineral matter or ash varies greatly in different specimens of muck both in its relative quantity and in its chemical composition. If sand and clay are washed or blown into the swamp and mixed with the muck, they will remain in the ash when the muck is burned and the ash may then form a large percentage of the weight of the muck. If no soil has thus been mixed with the muck, the ash will form about five per cent of the weight of the muck, and the combustible or organic material will form about 95 per cent.

The chemical composition of the ash may also vary greatly. If the swamp has sufficient drainage, much of the potash, soda, lime, etc. will be carried off in the drainage water, and the ash of such muck will be proportionally poorer in these materials. If the swamp is without natural drainage, these materials may accumulate by being carried in solution in surface water which flows into such swamp, and these are left there when the water evaporates. It is not very unusual to find a deposit of the carbonates of lime and magnesia at the bottom of such muck bed, constituting a bed of marl.

COMPOSITION OF ASH OF MUCK.

I have analyzed the ash from a muck found at the Agricultural College, and find the following results. The muck gave twelve per cent of ash, having the following composition:

Sand and clay	58.60
Carbonate of lime	8.39
Sulphate of lime (gypsum)	5.50
Phosphate of lime	1.33
Carbonate of magnesia	1.50

Carbonate of potash	1.82
Chloride of sodium	2.00
Oxide of iron	18.61
Silica	1.75
Moisture and loss	.50

The composition of the ash will vary so greatly with varying conditions of the muck bed, that the analysis of the ash of one specimen of muck will be no certain indication of the results of analysis of the ash from another muck bed. But the ash almost always contains lime, magnesia, potash, soda, and sulphuric and phosphoric acids—materials of great value in agriculture. We find therefore that muck has a certain agricultural value on account of the mineral which it furnishes to the farm.

COMPOSITION OF THE ORGANIC MATTER OF MUCK.

The organic or combustible matter of muck is formed by the successive stages of decomposition of vegetable matter. We find it in all stages from unaltered vegetable fibre, to its final conversion into carbonic acid. Chemists have distinguished a large number of those transitory products. The first indication of decay in vegetable fibre is a change of color, becoming brown instead of the whitish color of unaltered vegetable fibre. This material is called humin or ulmin; it is insoluble in water and in a solution of carbonate of soda. Vegetable matter in this condition is inert and without value as manure. By further oxidation it becomes changed into two feebly acid substances, called humic and ulmic acids, which are sparingly soluble in water, but readily soluble in solution of carbonate of soda. Their combinations with potash, soda, and ammonia are readily soluble in water giving a dark brown color to the water of many swamps. Their combinations with lime, magnesia, oxide of iron, etc., are all insoluble in water. By further oxidation these acids are changed into two other stronger acids, which are very readily soluble in water, and most of whose combinations with alkalies, with lime, magnesia, oxide of iron, etc., are readily soluble in water. Not to load your mind with unimportand terms and distinctions I will sum up this matter by saying that vegetable matter is first changed into an inert and insoluble material, next into a feeble acid whose combinations with the alkalies alone are sensibly soluble, and then into an energetic acid, readily soluble and most of whose combinations are also soluble. You may form some idea of the proportions in which these three classes usually exist in muck from the following estimate based on the examination of 16 specimens analyzed by Dr. Fisher under the direction of Prof. Johnson of Sheffield Scientific School. In 100 parts of organic matter, 16 parts were inert, 77 parts soluble in solution of carbonate of soda, and 7 parts were soluble in water and belonged to the crenic acid class. Or, to translate this statement into the technical language of the chemist, 100 parts of organic matter of muck contained, of ulmin and humin 16 parts; of ulmic and humic acids 77 parts; of crenic and apocrenic acids 7 parts.

This is by no means the invariable composition of the organic matter of muck, but merely gives you an approximate idea of the average composition of this material. Now this progressive change from inert materials into feeble acids, and from these to stronger acids, is one of increased activity and agricultural value, and the thing we should aim to secure in treating muck is to cause it to pass through these successive changes rapidly, but without loss of valuable material. But since an acid condition of the soil is injurious, while we develop

these acids we must at the same time provide some neutralizing material with which these acids may combine, i. e., we should seek to form salts with these acids. Lime, magnesia, potash, soda, ammonia may be used for this purpose, and any of these materials in the soil may serve this purpose and prevent any acid condition.

RELATIONS TO AMMONIA AND COMBINED NITROGEN.

These acids of muck are distinguished by a marked avidity for ammonia. So strong is their affinity for ammonia that it is quite difficult to free them from this base. Even muck in the muck bed is found to contain some ammonia, as I have repeatedly demonstrated. A specimen which I recently examined contained 5 pounds of ammonia in the ton of air dry material. And when this material has long been exposed to the air, the amount of ammonia is found to increase. As a class these vegetable acids may be called the ammonia traps of the soil. Ammonia is a valuable manural material because it contains so much combined or active nitrogen. It has become a very important question in high farming how to obtain a sufficient supply of combined or active nitrogen. It is the most valuable and costly element of manures. The agricultural world is now taxing its brains how to get enough nitrogen in the active forms of ammonia and nitric acid. Ships are sent to the Peruvian Islands to bring guano, which is valuable almost entirely for its ammonia. Other ships bring cargoes of nitrate of soda from Chili, which is of value almost entirely for its nitric acid. Earth and sea are ransacked for nitrogen in combined form; it is the urgent demand of advanced agriculture to-day. Yet the air contains an inexhaustible supply of nitrogen, for nearly four-fifths of air is nitrogen. At every moment it bathes every leaf and stalk of every growing plant, but the plant cannot take a particle of this nitrogen, for it is free or uncombined nitrogen, and it is only when nitrogen is caught and harnessed with hydrogen or oxygen that the plant can make use of this strange substance. The plant may be starving for nitrogen, and this material may be pressed against its very lips, but Tantalus-like it may not drink a particle. The great problem for agriculture to-day is how to catch and harness this wild colt for useful use. The success of agriculture hinges more upon the accumulation and preservation of available nitrogen than upon any other subject.

The old idea was that the products of decomposition of an organic substance would be rich in nitrogen in exact proportion to the amount of nitrogen in the original substance, provided that none escaped during the process of decomposition. You have all noticed partial illustrations of this principle. You all know how much stronger and more heating is the manure when your horses eat plenty of grain, than when they are fed on hay or straw. You have all noticed the strong odor of hartshorn or ammonia which the grain-formed manure gives off, while no such odor is given off by straw-made manure. It is needless to ask you which kind of manure will give you the best results in your fields. Now it is unquestionably true, as a general rule, that the manure will be valuable in proportion to the highly developed character of the food which the animal consumes.

But the mistake has been in assuming that all the nitrogen present in any decomposing material is there because it was originally present in the vegetable which is decomposing. A few years ago Deherain of France discovered that when any organic matter entirely free from nitrogen, *e. g.*, sugar, undergoes decomposition under favorable circumstances, it combines with nitrogen so that

the humous substance which is formed contains sensible quantities of combined nitrogen. So, also, when sawdust, which contains but a very small amount of nitrogen, decomposes under favorable circumstances, the quantity of combined nitrogen is largely increased. While the mosses and grasses which form our muck contain but a small amount of nitrogen, the muck contains on an average 2½ per cent of combined nitrogen. This may not seem a very large amount, but when you consider that stable manure contains only ¾ of 1 per cent, you see that swamp muck contains more than three times as much nitrogen as stable manure! In this one fact I believe we shall find our solution of the problem how to obtain our supply of combined nitrogen. We need not send to the far-off Pacific coast. We have got Chili and Peru in our muck beds!

But this nitrogen for the most part is inert or inactive, and to be of service must be converted into the active form. We have caught our colt, but we have got to harness him before he will draw our load. I will say something about the harness hereafter.

AGRICULTURAL USES OF MUCK.

The benefit which we seek to secure by the use of muck may spring from its *physical* and its *chemical* properties.

I. *Physical Properties.*

1. Muck may be used to improve the physical texture of soils. The two kinds of soils which require physical improvement are heavy clays and light sands. The physical properties of these two kinds of soils are diametrically opposite to each other, and they could be most effectually and permanently improved by mixing; but the expense involved in transporting any large quantity of soil forbids this kind of improvement if the soil has to be moved any considerable distance.

Clay Lands.—When clay land is first brought under tillage, the quantity of vegetable mold in such soil renders it easy to work for a few years; but the vegetable mold soon disappears, the land becomes lighter colored, more stiff and tenacious, and difficult to work. If it is now laid down to grass for a few years and then plowed up, the quantity of vegetable matter has increased, and the field is again easy to work for a time. If you do not want to lay it down to grass, the same physical improvement may be secured by a liberal dose of swamp muck. This substance renders clay lands more open and friable, and thus greatly improves their physical condition. To get the best results, however, this system must be combined with thorough drainage. In very wet clay lands, it may only increase their tenacity by addition of muck.

Light Sands.—On the other hand, light sands are made more firm and retentive of moisture by vegetable mold. Light sands retain too little moisture, and crops are liable to "burn" in dry weather; manure rapidly disappears in such a soil, and they are called "hungry and leachy." Such soils may be greatly benefited by a liberal dose of muck, which has a powerful affinity for moisture, and prevents excessive drying of the soil. It has also the power of absorbing and retaining manural matter, and of preventing its waste in the soil. When lands become too open and porous, farmers often lay them down to grass to "consolidate the soil." But this compacting of the soil is mainly due to the accumulation of vegetable matter, and this may be secured by the direct application of muck.

2. *Influence on Temperature.*—Ben. Franklin discovered that dark colored

substances, exposed to the sunshine absorbed more heat than light colored substances. The Swiss on the Alps hasten the melting of the snow in spring-time by sprinkling black substances on the snow. In Germany the vine-dressers hasten the ripening of their grapes by covering the soil with black slate.

The question arises, can we control the temperature of soils in our fields? It is often said that the farmer is at the mercy of the weather, but unfortunately the weather often has no mercy for the farmer. In 1868 I made a careful investigation of the influence of muck on the temperature of soils. These investigations extended from May 1st to Oct. 1st, embracing the period of active vegetable growth. The observations were taken 3 times a day for the whole period, *viz.*, at 7 A. M., and 2 and 9 P. M. The soils used for these experiments were tile clay, clean sand, tile clay with 12 per cent of muck, and sand with 12 per cent of muck. The temperature was determined by thermometers buried 2 inches in the soil so as to find the temperature of the soil where the roots work. In the following table I give you the average temperature for each month of each kind of soil used in the investigation. The full results of these investigations you will find in the Report of Board of Agriculture for 1868, pp. 137–149.

	Tile Clay.	Tile Clay and 12 Per Cent Muck.	Gain by Muck.	Sand.	Sand and 12 Per Cent Muck.	Gain by Muck.
May	59°.57	61°.25	1°.68	59°.57	60°.89	1°.32
June	70°.79	72°.02	1°.23	70°.89	73°.21	2°.32
July	81°.75	83°.07	1°.32	82°.07	86°.72	4°.65
August	70°.59	72°.32	1°.73	71°.25	73°.26	2°.01
September	57°.25	59°.22	1°.97	58°.59	59°.72	1°.13
Average gain	....	....	1°.59	....	....	2°.29

It will thus be seen that the farmer has a certain control over the temperature of his soil by the use of muck. The gain of 1½ to 2¼ degrees of temperature in the soil during the entire period of active growth is a great gain in our cool climate. If any soil is deficient in vegetable mold, that deficiency should be supplied from consideration of temperature, if for no other reason.

Another proof of the increased temperature of dark colored soils is found in the earlier ripening of certain crops. "Girardin of France, found in a series of experiments on the cultivation of potatoes, that the time of their ripening varied 8 to 14 days, according to the color of the soil. He found on Aug. 25, in a very dark humus soil, 26 varieties ripe; in a sandy soil, twenty; in clay, 19; in white lime soil only sixteen."—Johnson's How Crops Feed, p. 190.

This rule does not always hold good for grain crops, for you will often find that wheat will be more tardy in ripening on a very mucky soil. This may arise from an excess of ammonia formed in such soils, which may retard the ripening.

II. *Chemical Uses of Muck.*

1. Decaying vegetable matter is useful in agriculture because it powerfully promotes decomposition of the mineral constituents of the soil. In all fertile soils there is a large amount of mineral substances which have not been completely decomposed, which contain potash, soda, lime, magnesia, phosphoric

acid, etc., but which are not available for the growing plant because they are in an insoluble condition. The two most active agencies by which these materials are set free in a soluble form are water and carbonic acid; but by far the most energetic agent is carbonic acid. In a soil containing abundance of decaying organic matter there is a large amount of carbonic acid, and in such soil decomposition of inert minerals is comparatively rapid; whereas, in a soil destitute of organic matter the decomposition of mineral matter is very small. Although muck may itself contain only a small amount of mineral matter, yet it furnishes the gnawing tooth by which such mineral matter is set free in the soil for the use of the growing plant.

But the good offices of carbonic acid are not confined to soil-decomposition. About one-half of the weight of dry vegetable matter consists of carbon, and the plant derives its chief supply of carbon from carbonic acid. The air contains only a small amount of this gas, about one volume in 2,500, and it is found that plants thrive better in an atmosphere which contains a larger proportion of this gas. This larger proportion of carbonic acid is furnished to the plant by the carbonic acid in the soil. Decomposing organic matter in the soil, therefore, enables the plant to obtain a larger proportion of mineral matter, and also acts directly as food of the plant by furnishing an extra supply of carbonic acid.

2. Muck is valuable because of its marked power to absorb and retain ammonia. A very small amount of ammonia exists in the air, and from seven to nine pounds to the acre are brought down yearly by the rain and snow. This substance would rapidly escape from the soil if not absorbed and retained by the vegetable mold. A certain amount of literally *floating capital* in the air thus becomes *fixed capital* in the soil by the agency of muck.

3. It is a vast storehouse of fixed nitrogen. I have already stated that the organic matter of muck contains about 2½ per cent of fixed nitrogen, or 50 pounds to the ton. This amount of nitrogen is equal to that contained in more than 300 pounds of nitrate of soda or "Chili saltpetre," or more than 360 pounds of our ordinary saltpetre, or 560 pounds of guano. This enormous amount of fixed nitrogen thus stored up in our swamp muck is a fact of very great significance to agriculture. If we can devise any means by which this fixed but inert nitrogen can all be made active and available, the millennium of agriculture will be within ear-shot!

HOW TO USE MUCK.

1. In regard to the method of using muck for the physical improvement of the soil, I need offer no suggestions to the intelligent farmers before me. In regard to the kind of muck to use, I may say that any kind may be used if it is in the right physical condition, except one which is occasionally found which contains sulphate of iron or copperas. You may suspect the presence of copperas if a rusty scum forms on the water of a muck bed, and if the water turns black when infusion of tea is poured into it. If this "vitriol" muck be composted with lime, ashes, or marl, the sulphate of iron reacts with the lime, and forms sulphate of lime or gypsum, and no harm will follow the use of such muck. But copperas in any considerable quantity is very injurious. Even ½ of one per cent will render any soil barren.

2. *Composts.*—One of the most valuable uses of muck is in forming compost with fermentable manures. For this purpose even the crude or cheesy muck can be used. When one part of strong manure is mixed with 3 or 4 parts of muck, and the whole formed into a large compost heap, the whole mass passes

into active fermentation, the decomposing manure begets a like action in the muck; the ammonia, which would escape if the manure were fermented alone, is retained by the muck, and the final result is 4 or 5 times the quantity of manure that would have been obtained without the muck, and equal in quality, bulk for bulk, to the manure furnished without such composting. But I only drop a hint on this subject. Prof. Gülley, who has accomplished such wonderful results with this material, will tell the farmers more about this subject, and I gladly leave the matter in such able hands.

Another use of muck is to deodorize and preserve in an inoffensive form the manural matter derived from dead animals. When a dead animal is properly covered with muck, no offensive gases escape, and all the manural matters are preserved. Here is some muck which has thus been used, and you observe that it is not offensive to sight or smell. So also when night soil is composted with muck, a very powerful manure is formed in which all the disgusting qualities of the original material have passed beyond the reach of sight and smell.

NITRIFICATION.

But the most interesting consideration in regard to muck is its possibility of furnishing a vast store of available nitrogen for the use of plants.

Many years ago it was supposed that the organic matter of soil was the principal source of the organic matter of plants,—that it was in fact the special food of plants. Analogy was in favor of this view, for a carnivorous animal is best sustained by animal food, *i. e.*, food which has once passed the rounds of animal life; why should not a vegetable be also best fed by vegetable food, *i. e.*, material which has once passed through the rounds of vegetable life. But this theory received a fatal blow when it was shown that a plant might make perfect growth in a soil entirely destitute of organic matter. Liebig announced the law that plants live entirely on inorganic matter, and are incapable of absorbing and assimilating organic matter; and he has carried the great mass of chemists along with him. He taught that a plant could only absorb and assimilate carbon in the form of carbonic acid, and that the plant could not derive its organic material directly from the humus of the soil; that the plant could assimilate nitrogen only in the form of ammonia and the nitrates. That a plant can make use of nitrogen when in these forms is conceded by every chemist, but the question is now raised whether a plant may not obtain nitrogen from vegetable mold without its first passing into the form of ammonia or the nitrates. This is a more difficult problem to solve than appears at first sight, because the formation of ammonia or nitrates may go on all the while in soils charged with vegetable matter if the conditions in regard to heat and moisture are favorable to vegetable growth, and the question still remains whether the plant does not even then derive its nitrogen from ammonia and nitrates. Prof. Storer has lately published in the Bulletin of the Bussey Institution a very valuable article "On the importance as plant food of the nitrogen of vegetable mold." He claims that plants derive a large part of their nitrogen from vegetable mold, and that plants make a fair growth when vegetable mold is the only available source of nitrogen. Fields which have never been manured produce crops, and the wild plants of the forest derive most of their nitrogen from vegetable mold.

But that this supply of nitrogen is not sufficient for the use of the plant is shown in the fact that the growth of these plants is greatly increased by a dose of some nitrate. Even if the vegetable mold is such a source of nitrogen as to enable the soil to bear fair crops, this does not satisfy the farmer. He wants

not *fair crops*, but *large crops*, and for this he wants a supply of nitrates or some other active form of nitrogen. Your horse may be in fair condition and do a fair amount of work when fed on hay alone; but how much more he can accomplish with a liberal dose of oats! *The "oats" a farmer needs to feed to his fields are nitrates!*

How shall the farmer get these nitrates? He may buy them, but they cost money, and a good deal of it. It is a safe rule in farming, never buy what you can make for yourself at far less expense. Nitrates are naturally formed when moist and warm earth, containing lime, and charged with decaying organic matter containing nitrogen, is freely exposed to the air. This is the way that the artificial nitre beds are made in which most of the nitre of commerce is manufactured. But if any of these conditions are wanting,—if the soil is too dry or too wet, ir it is not properly opened to the access of air, if no lime or alkaline substance is present, and if there is no decaying organic matter, very little if any nitrates are formed. Under the proper conditions, this formation of nitrates will take place in any soil, whether we call it a nitre bed or a cultivated field. Indeed, a well cultivated field is a nitre bed on a large scale, and many operations of farming are simply means of promoting nitrification. For this, in part, at least, you drain, plough, harrow, cultivate, and hoe your land; and aside from destroying weeds and putting in seed, the whole of these operations are simply means of affording the conditions of nitrification. You have all noticed that frequent stirring of your soil does something more than to destroy weeds. The increased growth under such circumstances is an indirect result of nitrification in the soil.

European chemists have given much attention to this subject, and the researches of Boussingault and Bretschneider have shown that a large amount of nitrates are formed in fertile soils. The experiments of Bretschneider are especially valuable, because he examined this matter in the soil of a cultivated field, and thus gives us an insight into this matter under agricultural conditions. He found that the quantity of nitric acid in an acre of soil taken to the depth of 12 inches was 56 lbs. at the end of April; June 12 it had increased to 281 lbs. in one plot, and 270 lbs. in another; June 30th to 328 lbs. and 442 lbs.; July 22d it had decreased to 116 lbs. and 89 lbs.; Aug. 13th to 53 lbs. and 6 lbs.; and Sept. 9th, none.

The noticeable features of these investigations are the small amount of nitrates in the soil at the end of April, the large amount at the end of June, and their disappearance in September. What had become of these nitrates? Undoubtedly they were washed out by the rains, and had disappeared in the drainage water, for the soil has no power to hold in an insoluble form the nitrates. The amount of nitrates carried by the rivers into the sea every year is enormous. The Rhine is said to daily carry to the sea nitrates equivalent to more than 220 tons of saltpetre; the Nile every day pours 1,100 tons of nitrates into the Mediterranean Sea, and our Mississippi probably pours 2,000 tons of nitrates into the Gulf of Mexico every twenty-four hours. The nitrates formed in one year are not stored up to any appreciable extent for the next year's use, and spring opens upon the year's work with the treasury empty of nitrates: they form slowly in early spring, but rapidly in hot summer weather. But it is in early spring growth that these nitrates are especially needed to give our crops a good send-off. If your corn, your oats, etc., enter June with a good, pushing growth, you feel little anxiety about their future development. How to give our crops this early and vigorous start is a very important question in the management of

manures. It is not enough to tell us that in the heat of the summer's glow there will be enough nitrates for the use of the crop. The plant needs a supply earlier in the season, before the flush of the nitrates sets in. These facts give us food for profitable thought on the subject of manuring.

But one point that I wish to especially call to your attention is that in a soil destitute of organic matter, no nitrates are formed. If your fields are deficient in organic matter, *i. e.*, if they have less than the soil can properly use, in that proportion your fields are crippled in this important process, and your crops pay the penalty in diminished yield. Nature keeps an open account with us for a time, but she balances her books after a time, and from her final balance sheet the farmer appeals in vain.

The question how we may unlock the vast accumulation of inert nitrogen found in muck, is one of the most important subjects now before agricultural chemists. That a portion is made active when muck is mingled with the soil, and that soil fertility is thus largely preserved, I have already stated; but a large part never passes into the active form. The more thoroughly we can effect this conversion, the more will we add to the productiveness of our soils, and the more completely may we counterbalance the enormous drain on our fields by nitrates yearly washed away and finally lost in the all-devouring sea. We can consider agriculture placed on its proper vantage ground only when we can utilize all the waste materials now locked up in swamp muck.

But even with our present knowledge of this material and its properties, the farmer may greatly improve his agriculture by a wise use of this abundant material. The use of this substance in composting, by which the farmer may triple or quadruple his manure without any diminution of its value—the increased warmth of soil and capacity to withstand drought which muck imparts to every soil deficient in vegetable matter—the capacity of this material to furnish a certain amount of active nitrogen, the most precious and costly of all manural matter—these are facts which the thoughtful farmer will not let lightly slip through his fingers. Little as we know of this singular substance I have said enough to justify me to close as I began by quoting the words of Hon. John Dow, "I believe there is untold wealth in swamp muck."

DISCUSSION AT ALLEGAN.

Mr. Tomlinson.—Would it not do as well to grind swamp muck by machinery as to leave it to the action of the frost?

Dr. Kedzie.—It would not pay to grind it with machinery. The easiest and cheapest way is to let the frost mill do this work.

Spencer Marsh, Allegan.—Does soil ever lose its substance by leaching?

Dr. Kedzie.—When soils have no impervious strata, and are deficient in materials which will hold substances necessary for the crops, leaching may take place.

L. B. Phillips, Allegan.—Is there any great value in liquid manure?

Dr. Kedzie.—It is the *currency* of agriculture, for it contains most valuable manural elements, such as urea and the phosphates.

Jonathan Butler, Otsego.—Is this marl which is found in marshes good to put on land as manure?

Dr. Kedzie.—It is if your land is deficient in lime and magnesia.

H. E. Blackman, Trowbridge.—Is muck a better deodorizer than dry clay?

Dr. Kedzie.—As far as my experience goes it is better than dry earth.

Spencer March, Allegan.—In what consists the value of gypsum?

Dr. Kedzie.—That question is not under discussion.

L. B. Phillips, Allegan.—Would you advise muck to be left entirely exposed to the storms, or put under cover?

Dr. Kedzie.—That depends on circumstances. If it is where it will be washed severely it ought to be protected. At the Agricultural College the muck compost heap is in the open yard.

Levi Loomis, Ganges.—What would you advise in regard to the use of marl. Would you burn it?

Dr. Kedzie.—It is according to what you want to do with it. If you wish to secure its caustic effects it would be better to change it into quick-lime by burning; but if you wish simply to neutralize the acid properties of the soil, it will do just as well without being burned.

Jonathan Butler, Otsego.—Would this marl be good to use as a top dressing on wheat?

Dr. Kedzie.—I should incorporate it with the soil in good heavy doses. To sow it as you do plaster it would have very little effect.

DISCUSSION AT ADRIAN.

Horace Bradish.—Which is the most valuable: to compost muck with manure, load for load, or the clear muck after it has been exposed to the action of the frost?

Dr. Kedzie.—The compost manure would be the most valuable, because you would secure a more active state of fermentation, and nearly all of the ammonia would be saved.

C. A. Jewell.—Is the advantage of composting with manure sufficient to pay for hauling muck a considerable distance?

Dr. Kedzie.—That depends upon how far you have to haul it. If the distance is great, it would pay better to draw it out and leave it in small heaps, so that it will be thoroughly frozen during the winter. Mr. Gully, the farmer at the college, claims that this powdered muck, used as a top-dressing on meadows, will materially increase the yield of hay.

Burton Kent.—What benefit does muck receive combined with lime?

Dr. Kedzie.—The lime destroys the acid properties.

Dr. Owen.—Won't ashes have the same effect?

Dr. Kedzie.—Yes; even leached ashes would have a similar effect.

Dr. Owen.—What would be the effect of muck and ashes as compared with muck and barn-yard manure?

Dr. Kedzie.—It is a pretty difficult task to make a comparison of the two mixtures.

A TALK CONCERNING LIGHTNING-RODS FOR FARM BUILDINGS, GIVEN IN THE FARMERS' INSTITUTES AT ALLEGAN, DECATUR, ADRIAN, AND COLDWATER.

BY R. C. KEDZIE.

There are a few simple rules by which we may safely judge business men. For example, when a man is *exceedingly* anxious to sell an article, we may safely conclude, either that the thing has little value in itself, or that the person offering it for sale makes large profits by its sale. Would it be unjust to judge the agents for patent rights of every class, sewing-machine men, and lightning-rod

peddlers by this rule? It may be that a tender solicitude for your worldly prosperity is the main motive that influences the patent-right agent to offer you a splendid chance to make your pile by buying his patent. It may be a sudden sympathy for your overburdened wife that leads the sewing-machine man to offer you a machine for $100 that actually cost only $15. It may be that an overwhelming fear lest "your beautiful wife and dear blessed children should suddenly be destroyed by lightning" that leads him to offer you "the neatest, safest, and most scientific lightning-rod the world ever saw for only $75," which actually cost—you don't know how little. It may be that in entertaining these smoothed-tongued gentry we are "entertaining angels unawares," but in a business point of view it will not be financially sound to proceed on this "angels'-visit" basis. Their motives are too transparently benevolent, for we have no authentic account of angels having an inordinate appetite for greenbacks.

Now do not understand me to say that patent rights are all a humbug, that sewing machines are useless, or that lightning rods are of no worth. I simply call your attention to the motive which leads these men to so persistently urge their wares upon your notice. I will not charge the lightning-rod peddlers with urging the sale of their wares with an amount of cheek that has become proverbial,—that they study every device to come it over you, appealing to your vanity, your fear, your affection for your family, and even making your religious devotions a stepping-stone to their success,—but will leave you to say whether such things ever occur. Now, why this sudden and alarming interest in your welfare? Does it not spring from enormous profits secured? Why may you not put up your own rods and save this profit for yourselves?

I do not propose to discuss the question whether you should put lightning-rods on your buildings, but if you have for any reason determined to put up a rod, I will endeavor to tell you what kind of a rod to put up, and how to do it with the least expense to yourself and the greatest security to your buildings.

LIGHTNING-ROD.

A lightning-rod is a metallic bar by which unusual and dangerous amount of atmospheric electricity in the vicinity of your building may be safely conducted to the earth and dissipated in it, without injury to the building or its contents. Metals are used for this purpose, because metals as a class are good conductors of electricity; that is, a metallic rod of sufficient size will safely transmit through its substance a large quantity of electricity without being disrupted, melted, or dangerously heated, while a bar of wood in the same circumstances might be torn to fragments, or even set on fire. We find, therefore, that there are two classes of substances: one will silently and safely conduct large quantities of electricity; the other will not, but when a very heavy shock of electricity passes through it a kind of explosion takes place, and if the substance is a solid it may be shattered by the shock.

One of the best illustrations of non-conductors is cold, dry air; but warm, moist air is a much better conductor than dry, cold air, and this explains why chimneys with a fire, and barns full of recently cut hay and grain, from which ascend long columns of moist, warm air, are so liable to be struck by lightning. These columns of warm vapor, extending hundreds of feet towards the clouds, afford a readier passage of electricity to the earth, and serve to draw down the lightning upon such buildings.

While the metals are all classed as conductors, they differ greatly in their conducting power. Silver is the best conductor, but it is too costly a metal to

use for lightning-rods. Chemically pure copper stands next to silver as a conductor, but this is also a costly metal compared with iron, and besides, its conducting power varies greatly, according to its purity. Iron is much inferior in conducting power to copper. Chemically pure copper has more than six times the conducting power of iron, but inferior commercial copper often has only three times the conducting power of iron. Ordinary commercial copper may safely be estimated to have four times the conducting power of iron.

INFUENCE OF SIZE OF CONDUCTOR.

The conducting power of a metallic bar of a given length and of uniform size is proportional to its cross section. Thus an iron bar two inches square will conduct electricity as well as a copper bar one inch square, because it has four times the sectional area. By increasing the diameter of the bar of a poor conductor, we may make it equal in conducting power to a bar of better conducting material but of smaller size. While copper has four times the conducting power of iron, it costs much more than four times as much as iron. Iron is found in the market in the form of long bars, well suited for use as lightning-rods, while copper has to be specially manufactured for such use, whereby its cost is still more increased, because a material which is manufactured for a special use costs more than the same material manufactured for general use. Bar iron will cost from 3½ to 4 cents a pound, while bar copper will cost will cost about 50 cents. With ordinary bar iron we may therefore obtain the same amount of conduction at far less cash cost than we can with copper.

Another point in favor of iron is that it is so difficult to melt, the melting point of iron being more than 1,200° above the melting point of copper. A lightning-rod should not melt or become red hot by any stroke of lightning which may fall upon it. Arago of France, who directed especial attention to this matter, from all the data he could collect on this subject, came to the following conclusions: "That a flash of lightning could melt completely, and through its whole length, a chain of iron 130 feet long, of which the diameter of the different links was not above a fourth of an inch; that it might effect the fusion of a conical bar of copper nine feet long and one-third of an inch diameter at the base; that it could melt a leaden pipe of three inches diameter and half an inch thick; and finally, that lightning has never yet brought to red heat a bar of iron of half an inch in diameter."—Smithsonian Report for 1858, p. 368.

THE ROD.

There lie on the table before me many specimens of lightning-rods, such as are found in the country, and I think it would be difficult to crowd into so small a space a corresponding exhibition of sham and scientific humbug. Here is a rod made by twisting together three wires of tin. Tin is a comparatively poor conductor of electricity, and it melts at so low a temperature that if a full-grown flash of lightning should fall on such a conductor, there would be a spattering shower of melted tin! Here is a rod made by twisting together some fine wires of copper with some coarser wires of zinced iron. The wag who made this lightning-rod probably thought that by making a conductor which would resemble a galvanic battery the lightning would be so confused that it would slink off into the ground and ask no questions! Here is a rod made of copper tubing, and another made of copper wire in the form of a rope. Here is a rod made of iron, fluted and twisted into a spiral; and here are others made in the

same way, but galvanized. This rod looks like four solid copper wires twisted together, but on cutting into it we find they are iron wires covered with a thin wrapping of sheet copper. This rod looks like a fluted spiral of solid copper, but I have cut the rod with a file, and you see the central core is iron, with only a thin covering of sheet copper. What can we call such rods but humbugs and cheats?

One common object in the construction of these rods seems to be to give increased extent of surface; for this purpose we have the tube, bundles of wire, fluted forms, etc. Indeed lightning-rod men claim this increased extent of surface as one of the excellencies of their rods, "because electricity only exists on the surface of bodies." This is true of *static* electricity, or electricity *standing still*, as it is found on the insulated prime conductor of an electrical machine, but it is not true of electricity in motion, as every scientific man knows. There is a vast difference between electricity standing still and electricity in motion by conduction, and in lightning we have to do with electricity in motion, and in most tremendous motion! Static electricity is confined to the surface of an insulated prime conductor, but electrical conduction takes place through the mass of the conductor. On this point I could quote the highest authorities if it was necessary.

A rod which is both cheapest and safest is the one I would show you, and is the one recommended by Prof. Henry of the Smithsonian Institution, viz.: a solid round bar of iron, not less than three-fourths of an inch in diameter. Such a rod can safely conduct any flash of lightning.

INSULATION.

Another scientific humbug is the statement of these dealers that a lightning-rod must be insulated from a building; and for this purpose they place a small glass collar, one-half to three-fourths of an inch thick, in the staples that hold the rod, and want us to believe that the rod is insulated and that thus alone is all danger averted of the lightning leaving the rod and striking the house! A stroke of lightning that can shiver vast oaks, split rocks into fragments, and that can penetrate half a mile to a mile of air (the best of all insulators) before it reaches the rod, will hardly be insulated by a thimble of glass half an inch thick! On this subject Faraday says: "Some persons conceived that it is desirable to insulate the conductor from the wall of a building by glass, but all such contrivances are absurd, since the distance to which the metal could be removed from the wall by the interposed insulation was altogether insignificant compared with the distance through which the lightning must pass in a discharge from the clouds to the earth."—American Journal of Science for 1855, p. 140.

Indeed a good lightning-rod will afford more protection to a building when it is brought in complete contact with a building than when it is insulated from it.

LIGHTNING-ROD POINT.

Lightning-rod men make a great point of their lightning-rod point. I exhibit to you a number of these points. They all appear to be tipped with platinum—a matter of great moment in the estimation of lightning-rod men because of its infusibility. But when we look carefully into this matter, the excellence of platinum over copper in this respect is not so evident and for two reasons: 1st. Copper has more than seven times the conducting power for electricity that platinum has; 2d. "If equal quantities of electricity, whether obtained from

the galvanic battery or from the electrical machine, be made to traverse wires of different metals of equal length and diameter in the same interval of time, the rise of temperature in the wire is inversely proportional to its conducting power, and therefore the better the conductor, the less does it emit heat."—Millers' Physics, Vol. 1, p. 409.

From this it is evident that platinum, having only one-seventh the conducting power for electricity that copper has, would under the same circumstances be sevens times as much heated by a flash of lightning as copper would, and a flash which would heat a copper wire to its melting point (1,996° Fah.) would heat a platinum wire of the same size to 13,972° Fah.—a temperature greatly in excess of the melting of platinum. Of the two metals therefore, platinum would be more in danger of being melted by a flash of lightning than copper. For this reason, and also because it is a cheaper metal, I prefer a point made of copper with its surface gilded or nickel-plated to prevent rusting.

You will also observe that these patented points which I show you are very slender. They are objectionable on this account. In 1854 the Academy of Sciences of France, the highest scientific authority on such matters, drew up some instructions in regard to the construction of lightning-rod points. "The instruction of 1854 returns to advise a copper point, seeing that copper, being a much better conductor of electricity than platinum, it is less heated under the action of this agent, and consequently runs less risk of being altered by fusion, which frequently happens to platinum points. It is likewise necessary, with a view to avoid this inconvenience, whatever may be the metal of which the point is made, not to make it too pointed. A conical point, under an angle of 30°, is in this respect entirely suitable. It is true that we lose a part of the action by induction, exercised over a storm-cloud; but on the other hand we gain more than we lose, by the incomparably greater resistance that is opposed to fusion and to disintegration by lightning by a point which, instead of being drawn out to a point, is pointed only within the limit indicated."—De la Rive's Electricity, Vol. III., p. 162.

A solid copper cone, two inches in vertical height and one inch in diameter at the base, fulfills the conditions stated by De la Rive. Such a point I now show you. It can be screwed onto the point of your iron bar used for a lightning-rod, and fulfills all the conditions required in such a point. You can get these points of the Illinois Manufacturing Company of Adrian, Mich., of which Henry C. Hart is the agent. Single points can be obtained for $1, and when taken in quantity from 25 to 50, they can be got for 50 cents. It is not a patented article, and you do not have to pay a heavy royalty to the patentee when buying this point.

HOW TO PUT UP A ROD.

1st. For your rod, use round bar iron, not less than three-fourths of an inch in diameter. This you can get of any dealer in hardware, and should not cost you over $4 for a hundred pounds. On the top of your rod have a shouldered neck, with a screw that will fit the "female screw" in the base of your lightning-rod point. Get the blacksmith to bend one bar so as to give you a vertical rod from the peak of your roof, and another bar to turn from the edge of your roof, to reach the side of your building, to the ground.

2d. The rod must be in metallic connection through its whole length. It is not enough to hook or link the pieces together. Weld the pieces, or, more conveniently, screw them together by means of what are called "half-inch gas-pipe

couplings." Cut a thread on both ends of the bars, and then you can easily screw them together by means of the gas-pipe coupling. Paint the rod, and especially all the joints, with lamp-black and oil, to prevent rusting.

3d. Carry the lower end of your rod down to permanently moist earth. This is absolutely necessary for safety. Carry it into the well if convenient (but not into the cistern), but at any rate carry it down to earth that never dries. Fill the hole in the ground around the rod with powdered charcoal, because it is a a better conductor than the soil, protects the rod from rusting somewhat, and is very slow to dry when once wet.

4th. Spike or clamp your rod securely against the side of your building. All efforts at insulation are useless if you have a good rod and good ground connections.

5th. Protect the most exposed parts of your building: the chimneys of your house and the ventilator of your barn. Carry your rod as high as you can above the highest point of your building, and still have it well supported, so that the wind will not blow it over.

6th. Bring the rod in metallic connection with any large masses of metal in your building,—with the eave-trough, gas-pipe, etc.

COST OF SUCH A ROD.

In estimating the cost of such a rod, I leave out of account the work of the farmer in putting it up, and of the blacksmith in bending the rod and cutting the screws. I make an estimate of the cost of 100 feet of such lightning rod:

100 feet ¾-inch rolled iron=150 pounds at 4c	$6 00
Lightning-rod point	50
9 gas-pipe couplings, ½-inch	50
Paint and painting rod	50
Total cash cost for 100 feet	$7 50

A much poorer quality of rod, put up by lightning-rod peddlers, would cost from $35 to $75.

The difference, or $27 50 to $67 50, is the amount which the farmer may save by putting up his own rod, and having at the same time a much better rod. Is this sum worth saving in these hard times?

DISCUSSION AT ALLEGAN.

L. B. Phillips, Allegan.—If glass insulators are of no special benefit, why do telegraph companies use them?

Dr. Kedzie.—In one case men manufacture their own electricity, and want to save it; in the other case another party manufactures it, and men want to dispose of it.

Mr. Phillips.—I believe that gold melts at a low temperature.

Dr. Kedzie.—It melts at about 2,000°.

Mr. Phillips.—Then if these points are plated with gold will not that melt off?

Dr. Kedzie.—It won't melt off for the reason that the gold is in contact with a good conductor. To illustrate: if you take a silk handkerchief with a back of metal, you can place a live coal on it without burning the handkerchief.

Dr. E. Amsden, Allegan.—If we had a tube filled with water would that not make a better conductor than the ordinary lightning-rod?

Dr. Kedzie.—If the tube was sufficiently large to convey away the electricity

it would make no difference; but if not sufficiently large, and the tube should become heated, you might have a boiler explosion.

Spencer Marsh, Allegan.—Why don't lightning-rod men use the best materials?

Dr. Kedzie.—Because they want to make money.

Dr. Thomas.—If we deal with lightning in motion, can we expect that a stroke will be drawn to one of these rods?

Dr. Kedzie.—The rods do not draw the electricity, but simply serve to conduct the electricity from their neighborhood. It is not a necessary proof of the excellence of a rod that it is struck.

Dr. Thomas.—What distance will one of these rods protect from lightning?

Dr. Kedzie.—It depends upon the tension of the electricity. The French Academy of Science has claimed that a lightning-rod point upon a building will protect a circle the diameter of which is four times the height of the rod. It is not an invariable rule.

Henry Shultes.—What produces the heating effects of electricity?

Dr. Kedzie.—Resistance to its passage.

Rev. John Sailor.—Is it not friction?

Dr. Kedzie.—You can hardly call it friction. Scientists call it the conversion of force from one form to another.

Dr. Amsden.—Is there any objection to allowing the rod to touch the side of the house?

Dr. Kedzie.—No. The building would be better protected by spiking the rod against the side of the building.

Spencer Marsh.—What objection would there be to a horizontal rod with four points?

Dr. Kedzie.—The four rods might accumulate more electricity than one rod could carry off.

Dr. Thomas.—If one of these rods should attract the electricity, say 50 feet, would the flash go out of its course to pass down the rod?

Dr. Kedzie.—Most naturally.

H. D. Dewey, Allegan.—Why are forest trees so often struck by lightning?

Dr. Kedzie.—Because they are more elevated objects; hence more exposed.

W. W. Warner, Allegan.—You recommend that the rod should be spiked to the building?

Dr. Kedzie.—It is just as good as any other way, and is less expensive. I do not claim that this lightning-rod I have shown you is better than any other lightning-rod, but it is just as good, and as cheap as can be made.

B. D. Pritchard, Allegan.—There has been a rod sold in this county called the Hall copper-sheet rolled rod, and instead of being insulated it is spiked to the building.

Dr. Kedzie.—Its conducting power is proportional to the transverse section of the rod.

H. G. Buck, Hopkins.—Where a man has eight rods on his barn, I want to know if there wouldn't be terrible pulling and hauling?

Dr. Kedzie.—No, sir, not necessarily. The more numerous the rods the better the building would be protected.

H. G. Buck.—There was a stub standing near where I reside, about 60 feet high, and 2½ feet in diameter. Lightning struck it, shivering it to the roots, scattering the pieces in every direction to the distance of 20 or 30 rods. I want to know if such a current of electricity could be carried off by such a rod as the one you have shown?

Dr. Kedzie.—Yes, sir. I have never known a bar of iron one half inch in diameter to be melted, or even heated red-hot by lightning. As this rod is three-quarters of an inch in diameter, I believe it will answer every purpose.

Gen. B. D. Pritchard.—Do I understand you to recommend to these farmers that they put lightning-rods upon their buildings?

Dr. Kedzie.—I don't discuss that question.

H. E. Blackmore, Trowbridge.—Doesn't the rod against the side of the house augment the heat?

Dr. Kedzie.—When a cloud comes over, all bodies, whether conductors or non-conductors, are heavily charged with electricity. In the eastern portion of the State the steeple of a church was struck by lightning and destroyed. In all of the churches in the place were large congregations, nearly all of whom were thrown to the ground; and the people within half a mile of the steeple received a severe shock. Of course they were not struck, but the inductive charge of the cloud had produced an electrical disturbance in every person and thing under it. When the tension suddenly relieved itself this induced electricity was discharged into the ground. In Italy lightning struck a mountain near a road along which some miners were passing with their horses and carts. One driver noticed the man in advance of him, together with the horse, drop down dead. They were not struck by lightning, but the induced electricity had power enough to kill them both; and under each cart wheel was found a hole in the ground which had been formed by this induced electricity. Fulgurites were formed, which consist of grains of sand melted together by electricity.

Henry Shultes, Martin.—My barn is 68 feet in length. On it I have two lightning rods whose points are ten feet above the building, nicely insulated, and the bottoms of the rods connect with moist earth, for they are fully nine feet below the surface of the earth. Three years ago, during a heavy thunder-storm, a discharge of electricity struck one corner of the barn within 12 feet of one of these rods, passed through the shingles, out through the siding, and through a red elm post standing near.

Dr. Kedzie.—In that case, either the rule the Frenchmen gave was wrong, or else that lightning did not know its business.

DISCUSSION AT DECATUR.

Mr. Hendryx.—How do you fasten the rod to the building?

Dr. Kedzie.—By staples.

Mr. Hayne.—Is there anything like a rod carrying electricity off silently?

Dr. Kedzie.—Yes, sir. It is no proof that you have a good rod because it is struck.

Mr. Hayne.—What number of rods would you put on a building?

Dr. Kedzie.—On a common-sized building I would put one rod; if the building is large I would put up the second rod.

Emmons Buell, Kalamazoo.—Would you put a rod on a building?

Dr. Kedzie.—I said I did not propose to say anything about that when I commenced.

Mr. Buell.—I want to know if you advise putting up lightning-rods?

Dr. Kedzie.—That question I shall not answer.

Mr. Buell.—Have you got lightning-rods on the college buildings at Lansing?

Dr. Kedzie.—No, sir.

Mr. Buell.—That is all I want to know.

D. Woodman, Paw Paw.—What effect will rust have upon the rod?

Dr. Kedzie.—If the water penetrates the joints of the rod the rust will eat the thread of the screw and the rod become disconnected. To prevent this it is best to paint the rod with black paint or coal tar to prevent the entrance of the water.

Mr. Curry.—What distance will one rod protect?

Dr. Kedzie.—The French rule is that a point will protect a circle whose diameter is four times the height of the rod above the building; but that rule has been exploded, for a farmer at the Allegan Institute said his barn was struck within twelve feet of a rod, and the lightning did not see the rod at all.

Mr. Curry.—On a barn fifty feet long, would you recommend two points or one?

Dr. Kedzie.—That depends on whether the barn has one or two ventilators. I would put a rod on each ventilator. Last summer, on my way to Lansing from the college, I saw a small oat stack that had been struck by lightning and was burning. There were tall forest trees within 150 feet of this stack. The storm came from the west, the lightning passed over the trees, also passed over a larger stack standing by, and struck the small stack.

Joseph Gilman, Paw Paw.—Some fifteen years ago I built a church, and had occasion to put up a rod. At the top of the belfry was a block or post, and I passed the rod (a three-quarter-inch rod) down through this block or post. Did I do right by allowing it to pass through the post?

Dr. Kedzie.—If I was going to put up a rod I would rather carry it down upon the inside than the outside of the building. If I had a chimney stack in the center of my house, I would carry the rod down the side of the chimney into the cellar. It would then be out of the way, and I should feel a little safer than if it was on the outside.

Mr. Gilman.—The idea with some was that by passing the rod through the block the electricity would leave the rod and go into the block.

Dr. Kedzie.—Lightning never leaves an ample conductor for a poor conductor.

DISCUSSION AT COLDWATER.

L. R. Austin, Batavia.—Very many of the ideas advanced by Dr. Kedzie correspond precisely with my own views. It is well known to many in this audience that I was engaged in selling lightning-rods for many years. I have always thought that exorbitant prices were charged for many of these rods, and a great many times I have told the farmers how they might rod their own buildings with nail-rod very much cheaper than by purchasing these high-priced rods. While the Professor has explained the means by which we can gather accumulated electricity on our buildings, and conduct it to the earth without injury to ourselves and property, he has as much as said to you that to put rods on our buildings is to lack confidence in the author of the rain. With this sentiment I can not agree. I believe that we should utilize all the laws which science discovers in the protection of life and property.

NEWSPAPER DISCUSSION.

The following articles from the Coldwater Republican and Lansing Republican are inserted as a part of the discussion on Lightning Rods:

DR. KEDZIE CRITICISED.

From the Coldwater Republican.

Dr. Kedzie, in his "talk on lightning-rods" before the farmers' institute in this city, on Thursday evening, Jan. 20, not only left many of his hearers in doubt regarding his belief in the efficiency of lightning-rods, but advanced one theory, at least, that cannot be sustained by any other authority outside of the doctor's pronounced statement, and even that unsupported by argument or illustration, always desirable where a change is sought to be made in any seemingly well established theory or fact. I allude to his statement that "the extent of surface in a rod has no connection with its conducting power," that "electricity does not pass upon the surface of the conductor," and "that a round rod, solid in form, will conduct an equal amount of electricity with that of a hollow tube containing the same amount of metal but a largely increased surface."

After having devoted a considerable portion of my time to the investigation of this and kindred subjects, for the past 20 years, and having received as correct the teachings of men of more than state reputation,—of men whose published works are used as text-books in our schools and colleges, and carry with them weight throughout the scientific world,—I was surprised at the position assumed by a man of the doctor's intelligence and pronounced ability as a teacher in one of our most important state institutions. The doctor was correct in assuming that the fluted form was given to the rod exhibited by him, solely to increase its surface, and consequently conducting power; and I will now quote briefly from authorities (any one of which the doctor's position in the scientific world will hardly authorize him to question), relied upon to sustain a theory entirely different from that advanced by him upon the occasion referred to.

The distribution of electricity in an excited body is upon the surface.—[Silliman's Chemistry.

When electricity is communicated to a conducting body, it resides merely upon the surface, and does not penetrate to any depth within.—[Well's Nat. Philosophy.

When electricity is communicated to a conducting body, it does not distribute itself uniformly through the whole mass, but exclusively upon the surface.—[Draper's Chemistry.

When a body is electrified, the fluid with which it is charged lies at the surface of the body, and not at all within the surface. Hence electrical conductors, when hollow, will contain just as great a charge of electricity as when solid.—[Olmstead's Philosophy.

The experiments of Coulomb demonstrate that conductors contain all their electricity upon their surface, that is, the mass of metal cannot receive electricity, but only the surface of that mass. Therefore, the best conductor (of the same metal) will be the one that exposes the most surface. The thickness of the metal has nothing to do with its conducting power.—[Memoirs d'Academie.

Electricity passes entirely upon the surface of metals. A copper tube of one-half an inch in diameter, will conduct nearly twice as much electricity as could be carried away by a bar of copper of the same diameter.—[General Science.

Experiment teaches us that electricity is exhibited only on the surface of bodies.—[Chambers' Encyclopædia, vol. iii, page 814.

We learn from these and numerous other experiments that electricity is only found on the outer surface of conductors, in an envelop of inappreciable thickness. [Chambers' Encyclopædia, vol. iii, page 816.

It hath already been shown that the electric matter runs over the surface of conducting substances, in great quantities, like a stream of water running from one place to another.—[Cyclopædia Britannica, vol. vi, page 456.

Experiments of that electrician, Coulomb, demonstrate that conductors carry all their electricity upon the surface; that solidity (metal as a mass) cannot receive electricity.—[Cyclopædia Brittannica, vol. x, page 60.

Tubes for a given amount of metal expose the greatest surface and thus furnish the maximum capacity of conduction of the electrical current.—[American Cyclopædia, vol. x, page 528.

The number of unquestioned authorities might be multiplied, but space will not permit in a newspaper article. The foregoing, however, are sufficient to illustrate either the erroneous teaching of the past century, amply supported as it has been by experiments and experience, or the error of the doctor in his position regarding the conducting power of the surface of metals when utilized in the form of the modern lightning conductor.

A. T. LANPHERE.

January 22, 1876.

REPLY BY DR. KEDZIE.

To the Editor of the Lansing Republican:

Most of the authorities quoted by Mr. Lanphere to sustain his position that electric conduction is a surface action, and that it does not pass through the mass of the metal in a conductor, are treating of *static* electricity, or electricity standing still, and not of electricity in motion, which is the form with which we have to deal in lightning. I pointed out the difference between static electricity and lightning, so far as conduction is concerned, at the institute at Coldwater. These authors are speaking of the distribution of static electricity on the sruface of an insulated prime conductor, in which case it is confined to the surface.

But if electricity in motion is also confined to the surface and has nothing to do with the mass of metal in a conductor, how can we explain the common experiment of dissipating in an impalpable dust a large surface of gold leaf by a discharge from an electrical battery? Would a solid gold bar of the same extent of surface be thus burned up? In the case of the gold leaf we have a large amount of surface, but not enough mass of metal to carry away even this small amount of electricity. Again, how can we explain the fact that we can readily pass a charge of electricity through a wire fused into a piece of non-conducting glass? Such wires are fused into our eudiometer tubes, yet we find no trouble in sending a spark through such wires.

But let us compare some of the authorities quoted with each other:

We learn from these and numerous other experiments that electricity is only found on the outer surface of conductors, in an envelope of inappreciable thickness. [Chambers' Encyclopædia, vol. iii, page 816.

A copper tube of one-half inch in diameter will conduct nearly twice as much electricity as could be carried away by a bar of copper of the same diameter. [General Science.

Now will "General Science" or Mr. Lanphere tell me how much greater is "the outer surface" (where "only electricity is found") of a copper tube than that of "a bar of copper of the same diameter?" Has not "Gen. Science" been captured by Capt. Ignorance?

Mr. Lanphere intimates that I "advanced one theory at least that cannot be sustained by any authority outside of the doctor's pronounced statement," viz., that electrical conduction is not a mere surface action. I did not quote authorities to sustain my position because this theory is now so generally received by scientific men that I did not think it necessary to quote authorities. The authorities quoted by Mr. Lanphere, which are of any weight, are old and antiquated

The masterly researches of Coulomb and Faraday have indeed forever settled the question that in static electricity the whole of the electricity resides on the surface of an insulated conductor. Some of their cotemporaries assumed that

the same law would hold in the case of electrical conduction, but this is not the view held by the masters in this science. If the copyists and mere book-makers have handed down this erroneous view, that is their mistake and our misfortune; but erroneous views and false theories do not alter nature's laws.

I will now quote a few authorities,—not the compilers of text-books for district schools or those employed to write up some subject for a cyclopædia, but men who are everywhere regarded as masters in this branch of science, quoting from the highest authorities in England, France, Switzerland, and the United States.

In the British association in 1854, Faraday was requested to give his opinions in regard to lightning conductors. "On being asked whether a flat strip of copper was not better than a copper rod, Prof. Faraday said the shape of the conductor is immaterial, provided the substance and quality of the metal are the same."—[American Journal of Science for 1855, p. 140.

Prof. Miller of King's college, London, in his Chemical Physics, says: "It must be observed that in all cases of conduction the charge passes through the whole thickness of the rod or wire, and is not confined to its surface; it therefore makes no difference whether the metal is in the form of a wire, or is extended over a large surface as leaf."—[Chemical Physics, page 350.

Deschanel of France says: "There are two exceptions to the rule that electricity is confined to the external surface of a conductor: 1. It does not hold for electric currents. We shall see hereafter, in connection with galvanic electricity that the resistance which a wire of given length opposes to the passage of electricity through it depends not upon its circumference, but upon its sectional area. A hollow wire will not conduct electricity so well as a solid wire of the same external diameter."—[Natural Philosophy, p. 525.

De la Rive of Switzerland, in his work on electricity, which is everywhere ranked as the highest authority, says: "Davy, Becquerel, Harris, Cumming, and generally all philosophers who have directed their attention to the conductibility of bodies for electricity, have commenced by proving that the conducting power of a wire is in inverse ratio of the length, and in direct ratio of the section of the wire."—[Treatise on Electricity, vol. ii, p. 82.

Prof. Joseph Henry, secretary and director of the Smithsonian institution in Washington, the highest authority on electricity in this country, in his directions for the construction and erection of lightning-rods, says: "The rod should consist of round iron, of not less than three-fourths of an inch in diameter. * * * Other forms of rod, such as flat or twisted, will conduct the lightning, and in most cases answer sufficiently well. They tend, however, to give off lateral sparks from the sharp edges at the moment of the passage of the electricity through them, which might in some cases set fire to very combustible material."—[American Journal of Science for 1871, p. 344.

With such witnesses as Faraday, Miller, Deschanel, De la Rive, and Henry, bearing such decisive and indisputable testimony, I cheerfully submit my case.

Mr. Lanphere also complains that I left many of my hearers in doubt regarding my belief in the efficiency of lightning-rods.

I distinctly said in the beginning that I did not propose to give farmers any advice as to whether they should or should not attach lightning-rods to their buildings. A speaker should have the right to limit the field of his remarks. But since complaint is made that I did thus limit my subject, I will endeavor to answer all objection on this point, and tell what my belief is.

I believe that such a rod as I recommended at Coldwater and put up in the

way I there directed, will be a protection to a building to which it is applied; and if I had a barn-full of hay and grain, I should feel safer if it had such a rod. But in the trashy patented rods we so often find,—rods confessedly made of the poorest quality of iron, and so constructed as to rust off at the joints in a short time,—rods with a central core of poor iron but coated over with a thin wrapping of copper, so as to look like a solid copper rod,—rods twisted and convoluted in astonishing forms,—in such rods I do not believe. I fear that as they are sometimes put up they are a source of danger rather than protection. A friend lately said to me, "I know of five buildings struck by lightning, and they all had lightning-rods, and some of them had two!"—"How many buildings do you know which had no rods and yet were struck by lightning?"—"Not one!" Intelligent farmers usually draw their own conclusions.

Agricultural College, Jan. 28, 1876.

MR. LANPHERE'S REPLY TO DR. KEDZIE.

From the Coldwater Republican, Feb. 25.

I did not intend by my article of January 25th to invite a controversy with Dr. Kedzie, but to show that I, at least, did not accept his conclusions as correct. While it was noticeable that the experience of intelligent farmers,—who expressed themselves freely at the institute,—did not agree with the doctor's theories relative to the use of plaster and its results, the general silence of his audience upon the subject of lightning-rods led many to suppose that his views thereon were accepted as correct. I but do justice, however, to several prominent professional gentlemen who were present, to say that they have since expressed their unqualified dissent from a doctrine so new, so novel, and so entirely wanting in the important element of fact. Nor do I now desire controversy. Indeed, I did not then, nor do not now consider the question a debatable one; and when I quoted in opposition to the doctor such authorities as Silliman's Chemistry, Well's Natural Philosophy, Draper's Chemistry, Olmstead's Philosophy, Memoirs d'Academie, General Science, Chamber's Cyclopedia, Cyclopedia Britannica, and the American Cyclopedia, I supposed they were of sufficient weight to command the respect of not only the community at large, but even of Dr. Kedzie himself. In this, however, it seems I was mistaken, for Dr. Kedzie with an imperious wave of his pen pronounces the authorities quoted by Mr. Lanphere, which are of any weight, old and antiquated," and brushes the authors aside as "compilers of text-books for district schools, or those employed to write up some subject for a cyclopedia." The absurdity of this "fling" at district schools and cyclopedias will be apparent when we remember that the scientific works mentioned have been extensively used as text-books, not only in district schools, of which the doctor speaks with evident contempt, but in the academies and colleges throughout the land; while those selected to write up scientific subjects for the cyclopedia are men who occupy no questionable position in the science upon which they are called to write.

After his hasty, and, to himself, apparently satisfactory way of disposing of the authorities cited, he proceeds to quote from men "who," to use his language, are everywhere regarded as masters in this branch of science, in England, France, Switzerland and the United States," viz.: Faraday, Miller, Deschanel, De la Rive, and Henry. Now let us see just what bearing the quotations from these foreign gentlemen have upon the subject at issue.

Faraday's opinion was asked specifically as to whether "a flat strip of copper

was not better than a copper rod," and it is fair to presume that his answer was made with reference to the question asked. He says: "The shape of the conductor is immaterial, provided the substance and quality of the metal are the same."

Prof. Miller, in speaking of experiments in galvanic electricity, in which case the repulsive energy is so small that it pervades the whole body, says: "It therefore makes no difference whether the metal is in the form of a wire" (he is not speaking of a lightning-rod), "or is extended over large surface as leaf."

Deschanel, of France, says: "There are two exceptions to the rule that electricity isconfined to the external surface of a conductor: 1. It does not hold for electric currents. We shall see hereafter, in connection with galvanic electricity, that the resistance which a wire of given length opposes to the passage of electricity through it depends not upon its sectional area. A hollow wire will not conduct electricity so well as a solid wire of the same external diameter." Natural Philosophy, p. 525.

It will be noticed that he speaks of exceptions to the rule that electricity is confined to the external surface of a conductor. While thus confirming the general rule of surface conduction, he states the exceptions to be in the case of galvanic electricity. He is here in harmony with other great teachers upon this subject, including Prof. Henry, as we shall have occasion to show before we have done with this subject.

The elementary proposition quoted from De la Rive, of Switzerland, is a well-known, generally admitted, and nowhere questioned fact, viz.: that the larger the wire the more electricity it will convey; and that a long wire will not conduct the same amount of electricity with a short one of equal size. The same rule would undoubtedly hold good with regard to a lightning-rod, viz.: the larger the rod the greater the capacity, and the longer the rod of equal size the less its efficiency.

Of Prof. Henry he again says, before quoting him as to the form of a cheap and efficient lightning-rod, "Prof. Joseph Henry, secretary and director of the Smithsonian institution at Washington, the highest authority on electricity in this country." I will not copy his quotation; there is no issue between Dr. Kedzie and myself as to the efficiency of a ¾-inch rod; but I ask your readers to notice the fact stated by Dr. Kedzie, that Prof. Henry is the highest authority upon this subject in this country.

The issue between Dr. Kedzie and myself is distinctly made in my article of the 25th ult., where I quote from him as follows: "The extent of surface in a rod has no connection with its conducting power," and "electricity does not pass upon the surface of the conductor," and "that a round rod solid in form will conduct an equal amount of electricity with that of a hollow tube containing the same amount of metal, but a largely increased surface."

The doctor says, in reply to my article of the 25th: "Most of the authorities quoted by Mr. Lanphere to sustain his position, that electric conduction is a surface action, and that it does not pass through the mass of the metal in a conductor, are treating of static electricity, or electricity standing still, and not of electricity in motion." Can he be candid in this statement? Let us see.

Prof. Silliman of Yale College, a man who has no superior as authority in matters of this kind, defines static electricity as follows: "Bodies in their natural state give no evidence of its presence, but by different means it may be evoked from all. Hence statical electricity implies that condition of this subtle ether resting in all bodies in a state of electrical quiescence. Statical electricity

is the opposite of that state of excitement following friction, chemical action, etc., which is called dynamic electricity, or electricity in motion. Strictly speaking, all quiescent electricity is static, and all electricity in motion, from whatever source, is dynamic."

Prof. Henry supports this definition in his published works, and speaking of electricity, says: "The phenomena are of two classes, namely, statical, or those of attraction and repulsion, in which the electricity is at rest, and dynamical, or those in which the redundant electricity of one portion of space is precipitated into that of another in which there is a deficiency."

With the above definitions before him the intelligent reader can readily perceive which kind of electricity is spoken of in the quotations made in my article. I will simply refer to the authorities cited and the language employed characterizing the electricity spoken of. Prof. Silliman, an "excited body;" Wells' Natural Philosophy, "a conducting body;" Draper's Chemistry, "a conducting body;" Olmstead's Philosophy, "electrical conductors;" Memoirs d'Academie, "the best conductors;" General Science, "electricity passing," and "metals conducting electricity;" Chambers' Cyclopedia, "outer surface of conductors;" Cyclopedia Britannica, "conducting surfaces;" Experiments of Coulomb, "conductors carry the electricity upon their surface;" and the American Cyclopedia, "capacity of metals for conduction." Are these authorities speaking of quiescent electricity,—electricity at rest,—or are they speaking of electricity in motion?

The doctor's question with regard to the effect of electricity upon gold leaf loses much of its force when we consider that instances have been known where strips of copper two inches in width and one-sixteenth of an inch in thickness have been similarly affected by a stroke of atmospheric electricity. Indeed, it is not claimed by any that surface, without substance, is sufficient. Prof. Henry says that "if the charge be large and the conductor small, it will in some cases convert into an impalpable powder, or vapor, the solid particles."

And now for some authority having a direct bearing upon the question at issue. Prof. Henry, in an exhaustive article on atmospheric (not static) electricity, says: "Because electricity in a state of rest is found distributed at the surface of a body, it was immediately assumed, without examination, that electricity in motion passed along the surface; but this conclusion was supposed to be disproved by the fact that the conducting power of a wire for galvanic electricity is in proportion to the area of a cross section, from which it follows that this kind of electricity pervades the whole mass of the conductor. But galvanic electricity differs from common electricity, apparently in the exertion of a much less energetic repulsion, and in a greater quantity developed in a given time. The deduction, therefore, from the experiments with galvanism can scarcely be considered as conclusive in regard to frictional electricity. To settle this point the author of this paper (Prof. Henry) instituted a series of experiments, which conclusively proved the tendency of electricity of high tension, that is of great repulsive energy, to pass along the surface."

And speaking particularly of the construction of lightning-rods, the same author makes use of the following language: "Electricity, as we have seen, tends to pass at the surface of a conductor of a sufficient size;" and "the only proper way of diminishing the resistance to conduction in a cylinder of metal of a given capacity, is to mould it into the form of a hollow cylinder; a gas-pipe, for example, will offer less resistance to conduction than the same weight of metal in the form of a solid cylinder." Fearing that the doctor might call

these views "old and antiquated," as they were published some years ago, I addressed a communication to Prof. Henry, under date of Feb. 5, asking his present views upon the subject in controversy between Dr. Kedzie and myself, in which the following questions were asked:

1. Does a lightning-rod acting as a silent conductor, and in the absence of an explosive discharge, conduct the electricity mainly upon its surface? 2. In case of an explosive discharge upon a rod of sufficient capacity, does the electricity pass mainly upon the surface in its passage to the earth? 3. Will a metallic tube conduct more atmospheric electricity (or lightning) than a solid rod containing only the same amount of metal?

Under date of Feb. 9 I received the following reply to my inquiries:

SMITHSONIAN INSTITUTE,
WASHINGTON, D. C., 2d, 9th, 1876.

DEAR SIR,—In answer to your inquiries of the 5th inst., I have to state the following:

1. Atmospheric electricity, or that of great tension or repulsive energy, passes at the surface of a conductor, whether the discharge be silent or explosive. In the second case it is charged for an instant as it were by a wave of electricity, and tends to give off minute sparks to a conductor brought near it, however perfectly it may be connected with the earth. 2. This is answered by the first. 3. A given quantity of metal in the shape of a hollow tube will offer less resistance to a discharge of atmospheric electricity than the same amount of metal in the form of a solid cylinder. In galvanic electricity the repulsive energy is so small that the electricity pervades the whole mass, and hence the result obtained by experiments on the latter should not be applied to atmospheric electricity, in which the repulsive energy exists in the highest degree.

Truly yours, etc.,

JOSEPH HENRY, Sec'y.

A. T. LANPHERE, Coldwater, Mich.

As Dr. Kedzie has pronounced Prof. Henry the highest authority on electricity in this country, this letter would seem to be conclusive as between the doctor and myself. Yet, as he says, "I did not quote authorities to sustain my position because this [his] theory is now so generally received by scientific men that I did not think it necessary to quote authorities," I desired, if possible, to ascertain who, if any, among our scientific men shared his opinion upon this subject. With this view I addressed communications, similar to that sent to Prof. Henry, to Prof. Douglas of the Michigan University; Prof. Thomas Hill, M. D., late president of Harvard University, Cambridge; Prof. Edward Youmans; Prof. Benj. Silliman Jr., of Yale College; Prof. Joseph Lovering of Cambridge, and many others of our scientific men; and from the answers that have been received, almost uniform in their tone of opposition to Dr. Kedzie's theory, I will select three only, as this article is already longer than I intended it should be, reserving others for future use should the authorities quoted herein be pronounced "old and antiquated."

Prof. Douglas, under date of Feb. 12, says: "Yours is received and contents noted. I answer as follows: 1. The electricity is conducted on the exterior surface. 2. The passage is upon the exterior surface." He further recommends gas-pipe (being a hollow tube) for efficiency in the construction of a lightning rod.

President Hill, under date of Feb. 14, says: "I think there is no doubt that your carefully worded questions are all to be answered in the affirmative."

Prof. Silliman says: "Electricity resides only on the outer surfaces of excited bodies." And after describing several experiments which he deems conclusive, he says: "It is thus proved that all the electricity with which a conducting body is charged is disposed on its surface."

I have now produced authority sufficient to convince any thinking man of the doctor's error. He is doubtless more familiar with some other subjects than that of lightning rods; at least, it is to be hoped that such is the case. He certainly cannot consistently question authority which he has pronounced the best in this country.

To his allusion to the use of wires fused into eudiometer tubes, it is only necessary to reply that he is speaking of galvanic electricity and not of atmospheric electricity, or that of great repulsive power.

A word in reply to the doctor's display of wit and I have done. He asks, "Has not General Science been captured by Captain Ignorance?" This style of argument is the more noticeable, as it is seldom assumed by scientific men. But I leave the answer to his question to the public, hoping for the credit of our state institutions that Captain Ignorance will not be found to have carried his conquests within the sacred precincts of the State Agricultural College.

A. T. LANPHERE.

Coldwater, Feb. 21, 1876.

REPLY BY DR. KEDZIE.

To the Editor of the Lansing Republican.

In Mr. Lanphere's first article he stated that I "advanced one theory at least that cannot be sustained by any authority outside of the doctor's pronounced statement, viz.: that the extent of surface in a rod has no connection with its conducting power." When I produced quotations from Faraday, Miller, Deschanel, and De la Rive that fully sustained my position, I supposed the discussion was closed. But in his second article he attempts to evade the force of these quotations by saying they are speaking of galvanic electricity. In this, Mr. Lanphere exhibits either ignorance or dishonesty, for Miller and Deschanel are speaking of frictional electricity and not of galvanic electricity. He makes a further exhibition of ignorance when he says: "To his allusion to the use of wires fused into eudiometer tubes it is only necessary to reply that he is speaking of galvanic electricity, and not of atmospheric electricity, or that of great repulsive power." Ordinary galvanic electricity cannot be used for exploding gases in eudiometer tubes, as every intelligent electrician knows; but electricity of high tension must be employed.

In his first article Mr. L. quotes: "The thickness of the metal has nothing to do with its conducting power.—[Memoirs d'Academie."

In my reply I asked, if this relates to electrical conduction from place to place, how can we explain the fact that a broad surface of gold leaf can be dissipated in impalpable dust by a powerful electrical current. Mr. L. replies: "The doctor's question with regard to the effect of electricity upon gold leaf loses much of its force when we consider that instances have been known where strips of copper two inches in width and one-sixteenth of an inch in thickness have been similarly affected by a stroke of atmospheric electricity. Indeed, it is not claimed by any that surface, without substance, is sufficient." Here Mr. L. confesses that it is not true that "the thickness of the metal has noth-

ing to do with its conducting power!" At this rate, we shall need an "advisory council" to reconcile Mr. L. and the authorities he quotes. My question does not lose force, but acquires increased significance by his admission. The quotation from Memoirs d'Academie is true as applied to an "insulated prime conductor," but false as applied to electrical conduction from place to place, which is the only subject under discussion. Mr. L.'s confession confirms what I said in the first place, that most of the authorities he quotes are speaking of electricity *at rest* and not of electricity *in motion.*

Mr. L. endeavors to strengthen his position by quotations from correspondence with scientific men in our country. His quotation from Prof. Douglas seems to fully sustain his position. I wrote to Prof. Douglas, Feb. 28, calling his attention by direct quotations to the fact that he had arrayed himself against such men as Faraday, Miller, Deschanel, and De la Rive, and asked him which was right? I have not received an answer.

He also quotes from Prof. B. Silliman, Jr. If we may trust the newspaper reports from Washington, it seems that "lightning has struck" in the vicinity of the Emma mine; and when Prof. Silliman satisfactorily explains his connection with that stupendous fraud, and his receipt of a fee of $25,000 for sending a dispatch which has disgraced the American name before the whole civilized world, scientific men will be more ready to receive his opinion on other scientific subjects.

In regard to the quoted reply of Prof. Henry, I frankly confess that it filled me with astonishment. The only reply I now make to his letter is that he has arrayed himself in direct opposition to the great mass of scientific men in Europe and America. Let me quote a few authorities to sustain this position, in addition to those I quoted in my former article.

Gmelin, under the head of frictional electricity, says: "The conducting power of a wire of any given metal varies directly as its transverse section and inversely as the square of its length."—Vol. I., p. 310.

Watts in his Chemical Dictionary says: "The resistance of a wire or any other conductor of given length varies inversely as its transverse section."—Vol. II., p. 466.

James Clerk Maxwell, professor of experimental physics in the university of Cambridge, England, has written a work on electricity and magnetism in two large octavo volumes, in which he makes a rigid application of mathematics to the problems in electricity. When speaking of electricity *at rest* he always treats it as having *two dimensions* (surface); but when speaking of conduction, he treats it as having *three dimensions.* "In the one case it involves *surface* only; in the other case it involves length and *area* of the conductor." Thus, he says: "If the conductor is to be treated not as a line but as a body, we must express the force on the element of length, and the current through the complete section, in terms of symbols denoting the force per unit of volume, and the current per unit of area."—[Vol. II., p. 226.] He then goes on to say: "If S represent the section of the conductor," etc.

A Cambridge professor would not apply the calculus of three dimensions in discussing the mathematics of electrical conduction, if only two dimensions (or surface) were involved. This work was issued at Oxford, England, in 1873, and is standard authority.

John Scoffern, late professor of chemistry at the Aldersgate school of medicine in England, in his Chemistry, p. 225, has a very forcible article on the *outsidedness* of electricity, which would delight Mr. Lanphere; and on p. 226

he continues as follows: "Thus, the general proposition is demonstrated that electricity resides on the surface of bodies, not penetrating to any sensible depth; hence the capacity for electricity will be proportionate to the area of surface. It must be pointedly inculcated, however, that this remark only applies to electricity in a static or motionless condition. Where electric currents are concerned, the power of a conductor to transmit a given charge is proportionate to the mass of conductor of equal conducting power. This is a circumstance of great practical importance; on its comprehension is based the construction of slightning rod."—[Scoffern's Chemistry, p. 226.

But as Mr. Lanphere does not seem to relish European authorities, I will give him a few quotations from eminent American authorities.

Henry Morton, president of Stevens' technological institute of New Jersey, says: "Conduction in dynamic electricity resembles in all respects the same action in the statical condition of the fluids. On account of the inappreciable condensation of a current, the conductor does not act mainly by its surface, but by its entire section."—[Johnson's Universal Cyclopedia, p. 1513.

In order to settle the precise points of dispute between Mr. Lanphere and myself, I wrote to three professors in as many eminent colleges in our land,—men whose opinions are everywhere received as authority by really scientific men. From the fact that they are actively engaged in teaching this science, we are assured that they are fully informed on the latest facts and opinions on this subject.

As I wrote in almost the same words to all of these professors, I will save space by giving only one copy of my letter, viz.: the one I sent to Prof. Loomis, who is professor of natural philosophy and astronomy in Yale college, and author of a treatise on meteorology that is used in most of the colleges as a textbook on this subject. The Yale professor of natural philosophy and author of a standard work on meteorology would probably be as good authority on conduction of electricity as any quoted by Mr. L. Prof. Loomis knows something about lightning rods, as is shown by his replies to my questions in the following letter. I give his answer to each question with the emphasis which he himself employed.

LANSING, March 7, 1876.

Prof. Loomis,—Dear Sir:—Pardon a stranger for intruding on your time and taxing your patience. I ask your opinion as a leading authority on meteorology, on the subject of conduction of atmospheric electricity. Enclosed you will find a slip containing the opinions of Faraday, Miller, Deschanel, and De la Rive, on the points involved; but these European authorities are called in question by an aggrieved lightning-rod dealer, and I wish to obtain the views of a few leaders in science in this country. Will you favor me with brief answers to the following questions:

1. Are Faraday, Miller, De la Rive, and Deschanel correct in their teachings that a current of electricity is not conducted by mere surface action? YES.

2. Does increased surface (as in a tube), give increased power of conduction of lightning? NO.

3. Will a *tube* afford better conduction than a *solid bar* of the same diameter? NO.

Pardon me for asking such questions, but I do it in behalf of public health, and the protection of the masses against lightning and lightning-rod peddlers.

Very Respectfully, R. C. KEDZIE.

In a postscript Prof. Loomis adds: "*Statical* electricity resides wholly on the *surface* of the conductor; but the capacity of a conductor to convey a *current* of electricity is proportioned to the area of a cross-section.

E. LOOMIS."

The next letter was from E. S. Snell, professor of mathematics and natural philosophy in Amherst College:

"AMHERST COLLEGE, March 11, 1876.

"R. C. Kedzie, M. D., Dear Sir:—Yours of the 7th inst. is just received. My opinion on the subject proposed rests on the authority of such men as are named on the slip accompanying your letter. * * * For many years I have taught that the amount of electricity that can be contained in *a state of rest* in an insulated conductor depends on its *extent of surface*, and easily prove it by experiments; but that *the power to conduct* electricity from one place to another (the length and material being given) depends on *the area of the cross section*, and not on the amount of surface. * * * And I know of no authorities opposed to it.

"The above answers questions 1 and 2. It follows that increasing the surface without increasing the area of the cross section does not increase the conducting power of a lightning-rod.

"3. A *tube* and a *solid rod* being made of the same metal and having the same length and diameter, the rod will conduct as much better as its cross section is greater in area; or, which amounts to the same thing, as its weight per linear foot is greater. * * * The 'lightning-rod dealer' probably misunderstands statements made by American authors. * * *

"I have known students and 'peddlers' to jump at once to the conclusion that the law would be the same in both cases, which is contrary to established facts.

Yours truly, E. S. SNELL."

The third letter is from Ogden N. Rood, Professor of Physics in Columbia College, New York city:

"COLUMBIA COLLEGE, March 15, 1876.

Prof. R. C. Kedzie, Dear Sir:—I have received yours of March 7, containing three questions to which you desire answers. Your first question is as follows: 'Are Miller, Faraday, De la Rive, and Deschanel correct in the positions quoted in the printed slip, or is the old idea that atmospheric electricity is conveyed by mere surface action the received opinion?' to which I would answer that according to my opinion and that of the whole body of physicists, as far as I know it, the authorities quoted by you are correct. Question 2: 'Does increased surface, as in a tube, give any increased conduction of lightning?' No. Question 3: 'Will a tube of any given metal afford better conduction than a solid bar of the same diameter?' No.

"Very respectfully,

OGDEN N. ROOD."

With such indorsements of my position by Yale college, Amherst college, and Columbia college, I am satisfied to rest my case.

I am not surprised that Mr. Lanphere strikes out wildly to defend his position. When a man "has a soft thing," selling his wares at a very large profit, and when these special wares are chiefly in demand because of popular error on a scientific point, it is natural that such a man should keenly resent the intrusion of science which destroys his lucrative monopoly. This is no new exhibition of human weakness. In an old and trustworthy book I find the following: "And at the same time there arose no small stir about that way. For a certain man named Demetrius, a silversmith, which made silver shrines for Diana, brought no small gain unto the craftsmen; whom he called together with the workmen of like occupation, and said, 'Sirs, ye know that by this craft we have our wealth. * * * Not only this our craft is in danger to be set at naught, but also that the temple of the great goddess Diana should be despised, and her magnificence should be destroyed, whom all Asia and the world worshippeth.' And when they heard these sayings they were full of wrath, and cried out, saying, 'Great is Diana of the Ephesians.'"

Human nature is much the same, whether at Ephesus or at Coldwater!

STATE AGRICULTURAL COLLEGE, Lansing, March, 1876.

LECTURE ON PLASTER.

BY R. C. KEDZIE.

The most characteristic feature of American agriculture is the use of "plaster" or gypsum, just as lime is the leading characteristic of English agriculture. In moist and cool climates and situations where the decomposition of organic matter in the soil is slow and lingering, and where accumulation of peaty matter is excessive, we find lime is a favorite manural substance, and it is used in large quantities. But in hot and dry climates where vegetable matter rapidly passes through its successive transformations into its final conversion into carbonic acid, we find lime in less favor, or used in much smaller quantities. Thus in the United States, France, and Germany, 30 to 40 bushels of lime to the acre is considered a liberal dose, while 300 or 400 bushels are not considered an excessive dose in England.

In countries where lime is less beneficial we often find gypsum in high esteem. Thus gypsum is a favorite manural substance in the United States and Continental Europe, while it is considered of small worth or even useless in England. The esteem in which this substance is held seems to be largely determined by conditions of climate.

HISTORY.

The use of gypsum as a manure is of modern date. Attention was first called to its value in agriculture by a German clergyman, Pastor Meyer, about 1750. Benj. Franklin introduced it into this country from Paris in 1772—hence its common name "Plaster of Paris." In order to direct the attention of Americans to the manural value of this substance, Franklin adopted the ingenious method of sowing plaster on a large clover field in Washington so as to form the words, "This has been plastered." The vigorous growth of the clover on which the plaster had been applied enabled every passer-by to read the words and thus grasp the fact and the explanation at the same time.

The introduction of gypsum as a manure encountered vigorous opposition from the salt-boilers. In boiling down brines in Europe to form salt, a deposit forms in the pan called schlott, which was raked out and sold as manure. The salt-boilers declared that "gypsum was injurious to the land while schlott was the only improver—the stimulant of stimulants." A fierce paper war arose which might have raged to this day had not some one analyzed schlott and found it was sulphate of lime or gypsum.

Like all new substances of real value, gypsum was the victim of over praise. Thus it was claimed that gypsum was a universal manure, was capable of replacing all other kinds of manure, was beneficial to all kinds of crops, and that the most barren soil could be brought into fruitful condition by the use of gypsum. But experience soon moderated these extravagant claims, and assigned a much more contracted field to the useful application of this substance, showing that while its application is very beneficial to certain plants, the number of these was quite small, and the application of gypsum to other plants had little or no influence.

Gypsum was first imported into this country from the quarries of Montmartre, near Paris. It was afterwards discovered nearer home at Nova Scotia, then

in New York, then found in abundance in our own State, and has since been discovered in many States of our Union. Inexhaustible deposits of this valuable mineral have been discovered in Kansas. According to the last State census 128,000 tons of plaster were quarried in our State in 1873. If we add to this the amount brought into the State from Ohio and Canada, the value of the plaster yearly used in our State will not fall below half a million dollars, and probably much exceeds that sum. If any large portion of this plaster is used in such a way as not to yield the best possible results, a very large leak in the profits of farmers of this State will thus be discovered.

THEORIES OF ACTION OF PLASTER.

Many theories have been advanced to account for the peculiar value of plaster as a manure. Hlubeck gives the following summary of theories which have been advanced on this subject:

"Acts like any other food."—Ruckert.

"Merely improves the physical properties of the soil."—Pastor Meyer.

"Is an essential constituent of the plant."—Reid.

"Gypsum is the saliva and gastric juice of the plant."—Hedwig.

"It is a stimulant, by which the circulation of the plant is increased."—Humboldt & Thaer.

"It is an essential constituent of plants, because it acts only when gypsum is deficient in the soil."—Sir Humphrey Davy.

"It fixes the ammonia of the atmosphere."—Liebig.

"It furnishes sulphur for the legumin of leguminous plants."—Braconnot & Sprengel.

Many of these theories are mere fanciful conceits, founded upon analogies drawn from animal life, and demand no very careful consideration at our hands. Others have important truths, and demand more careful consideration.

KINDS OF SOIL ON WHICH GYPSUM ACTS BENEFICIALLY.

All persons who have carefully noted the effects of gypsum when applied on different kinds of soils have observed that on dry, porous, gravelly or sandy soils the effect is much more marked than when applied to stiff, tenacious clay lands, especially when they are wet or water-soaked. So, also, the influence is more marked in a rather dry season than in a very wet season. The influence of plaster is very little or nothing on a soil destitute of vegetable matter, unless manure is applied in connection with the plaster. The presence of a good supply of vegetable matter in the soil I consider to be essential to the best influence of plaster, and if the soil is deficient in vegetable mold, that deficiency will limit the action of plaster. The use of plaster by itself tends to dissipate the vegetable matter in the soil, and if this tendency is not counteracted by such a system of cropping as will tend to accumulate vegetable matter in the soil, the use of plaster may tend to exhaustion of the soil. Many farmers complain that while plaster at first seemed to benefit their lands, after a while it seemed to have no beneficial effect. This may have arisen from lack of vegetable matter in the soil. At any rate this is a possible condition which should be borne in mind in the use of plaster.

COMPOSITION.

Gypsum or plaster is sulphate of lime, or a union of sulphuric acid (or oil of vitriol) and lime; and contains two equivalents of water of hydration. The percentage composition is nearly as follows:

Lime	33
Sulphuric acid	46
Water	21
Total	100

If plaster is heated for some time to 400° it loses its water of hydration, and then becomes "boiled plaster" or stucco, having the power to again combine with water when mixed up with it, and setting in a mass nearly as hard as the original stone from which it was formed. It is sparingly soluble in water, one part of gypsum dissolving in 500 parts of water. Water holding this substance in solution is "hard," and unfit for most domestic uses.

Gypsum is sometimes found of a very compact structure, and partially transparent. It is then known as alabaster, and is much used for ornamental purposes. It is sometimes found perfectly crystalized and transparent like glass, and is then called selenite. But its composition in these various forms is still the same as the material we grind up for plaster.

INFLUENCE ON PLANTS.

The most marked influence of plaster on plants is a large increase in the formation of leaf and stalk, as distinguished from the formation of seed; at the same time it imparts a dark green color to the leaves of the plant, giving an impression of very vigorous growth. It is also found to impart a peculiar tendency to the development of leaves in a plant, so that it not only develops leafy plants, but the leafy parts of plants. The plants which are especially benefited by plaster are usually those of a very rapid growth: *i. e.*, plants which naturally complete their growth in a comparatively short period of time.

This increased vigor of growth, the larger stem, more numerous leaves, and especially the rich green color of the leaves, makes the farmer feel certain that the plaster has greatly benefited his crops. He needs no better evidence, for he can *see* the improvement, and seeing is believing. This would be satisfactory if the herbaceous part of the plant constituted its chief value. But if it is some other part which is chiefly valuable,—the grain instead of the straw—and if the plaster has simply increased the straw, without a corresponding increase of grain, the farmer may be greatly misled by judging of the effects of plaster simply by the looks of his crops.

Plants manured by plaster are also said to form a larger proportion of the highly organized products of plant life. Professor Storer, in a late Bulletin of the Bussey Institution, p. 276, says: "Analysis has shown that plants manured with gypsum or with Epsom salt are often richer in nitrogenous constituents than those grown upon adjacent land that had not been manured." It would seem thus to contribute especially to the development of those constituents of the plant which go to build up the muscular tissues of the animal and give him power of endurance: which make him strong rather than fat.

KINDS OF PLANTS BENEFITED.

We now enter upon a topic concerning which there has been a great diversity of views. On such a subject the first and most important appeal is to the experience of farmers. We must first ascertain the facts, and then explain these facts by general laws if we can; but it is not safe to frame the law first, and then decide by this what the facts should be.

Boussingault gives a summary of a very valuable report made to the Royal

Central Agricultural Society of France. I quote from his Rural Economy: "This report shows in a striking manner the advantage that may be derived from the lights of practical men; in a single line or sentence we frequently find a summary of twenty or thirty years of experience. It is, however, indispensable to go to these gentlemen for their information; the agriculturists who devote themselves to cultivation, it is notorious, write very little, and those who spend very little time in this way, on the contrary, write a great deal. It may be that the reason for the silence of the one, is that also for the eloquence of the other.

"The following series of questions and answers I believe to embrace most of the points connected with the employment of gypsum that are of interest:

1. "Does plaster act favorably on artificial meadows? *i. e.*, meadows of clover, sainfoin lucern, &c. Forty, yes; three, no.

2. "Does it act favorably on artificial meadows, the soil of which is very damp? Unanimously, no.

3. Will it supply the place of organic manure, or of vegetable mold? *i. e.*, will a barren soil be converted into a fertile one by the use of plaster? No, unanimously.

4. Does gypsum sensibly increase the crops of cereals? Thirty, no; two, yes." —Rural Economy, p. 320.

With the exception of the fourth question, I presume the farmers of this country will agree with the views of the farmers of France.

Boussingault for two successive years made some very careful experiments to determine the influence of plaster on wheat, oats, and rye, and found that it had no influence to increase the yield of grain. He thus sums up the value and uses of gypsum: "that it acted beneficially on a certain, and that a very small number of plants; that it was upon artificial meadows, constituted by clover, lucern, and sainfoin, that it produced its best effects; its action, on the contrary, being scarcely perceptible upon natural meadows, doubtful in connection with hoed crops, and null on cereals. These negative results cannot be called in question; they were come to by parties who were every way interested in having the decision otherwise."—Rural Economy, p. 319.

I think it is the general verdict of farmers in this State, that on the proper kinds of soil in the right condition, plaster is very beneficial to all kinds of the clover family, red clovers, white clover, alsike, etc.; that it does not directly increase the yield of our summer grains, wheat, oats, barley, rye, etc.; but in regard to corn there is less unanimity of opinion.

The farmer applies plaster to his clover field and he sees a marked increase in growth, and when he gathers his hay he finds his crop doubled; the after growth is also heavier for the plaster, and when he ploughs up his field and sows wheat he gets a better crop than from another similar field to which no plaster has been applied. He is well satisfied with the result, and well he may be. "Now," he reasons, "if plaster has helped my clover so wonderfully, why will it not help my corn?" He applies plaster and seems to see a corresponding benefit in an increased vigor of growth. A while ago I had a talk with neighbor Brown on this point, "Do you use plaster on your corn?" "I never fail to use it!" "Do you get any benefit from it?" "If I can believe my own eyes, I do! I aim to put it on every hill of corn; sometimes by mistake a row is missed, and I can tell that row clear across the field by its paler color. My neighbor uses it—sometimes in very small doses, only a teaspoonful to a hill—but the corn just climbs right up after him!" "No doubt you get more

stalks, but have you ever tested the matter to see if you get more corn?" "No." "Well what you want is not the flaunting frushy stalks, but the solid golden-eared corn. Try the very simple experiment of taking alternate strips in your cornfield, and apply to one set plaster, and leave the other without plaster, and then test the results in your corn-basket or by the scales, and not by your eye. Get your neighbors to make the same experiment, and then compare results, and let us *know* something of what plaster does for corn. Now you can find learned professors who will demonstrate to you that an experiment so loosely contrived as this will never prove anything—that an experiment that does not prove anything to a mathematical demonstration is good for nothing. Well, if we must wait for experiments in agriculture that will be mathematical demonstrations, we must wait a long time—for example, till expansion of the currency shall bring us to a specie basis! Agriculture at the best is a science of probabilities. We seek to make the probabilities as strong as possible by excluding all known sources of error, and by multiplying the experiments seek to exclude unknown sources of error. We may never reach demonstrations of mathematical exactness, but we reach the same class of probabilities upon which we risk safety and life from new year's chime to old year's death.

I learn from the newspapers that a farmers' club of Van Buren county tried this experiment with corn, each farmer cultivating his field in alternate strips, with and without plaster; at the end of the year each farmer tested the result by his basket, and then they all came together to compare results, when they concluded that no increase of corn was secured by plaster. It may be that this was an erroneous conclusion; but is it not time to know whether we are wasting plaster, and if so, stop the waste? I say *waste*, because plaster applied to any crop without benefit to that crop, is practically wasted, because much of it will be washed out of the soil and lost before another crop is grown on that field. You may say that loss is small for each farmer, but when you multiply the loss by all the farmers in the State, the loss mounts up to startling thousands of dollars. I consider it a question of great financial importance to the farmers of our State to determine what crops are really benefited by plaster. By having a very large number of persons engage in this examination on a great variety of soils and under different climatic conditions, we exclude a great many sources of error, and reach results of greatly increased value. A State that annually uses half a million dollars' worth of plaster should know what she gets for her money.

Many persons have questioned the value of plaster as a manure because it does not under all circumstances benefit crops, and the low estimate in which it is held in the British Islands is quoted as proof of its small value. But if we claimed that a substance could have no manural value unless it was beneficial under all circumstances, we might deny the manural value of every substance. A manure is of value when it supplies, directly or indirectly, some material which is not present in sufficient quantity or in available form to completely supply the wants of any given crop.

If the soil contains abundance of any given substance, the further application of that material may not benefit the crop. Sir Humphrey Davy examined some English soils and found they contained one per cent. of sulphate of lime. This may seem a small amount at first sight, but when we remember that an acre of soil taken to the depth of twelve inches is estimated to weigh 4,000,000 lbs., we see that the one per cent. signifies the presence of twenty tons of plaster in each acre, which would be an enormous manuring. When a soil already contains

twenty tons of plaster, we should hardly expect that the addition of fifty or one hundred pounds would produce any marked effect.

It is sometimes observed in this country that after plaster has been uesd many years, and especially if used in large doses, it ceases to be beneficial. The explanation may be, that the soil then contains so much of the material that further additions are not for the time needed. The explanation I have seen in the newspapers, that "the plaster was too old—had lost strength by keeping," has no foundation in fact, because plaster is a fixed and changeless substance, and does not lose strength by keeping any more than does common salt. Old plaster is just as strong as new.

WHY DOES PLASTER BENEFIT CROPS?

1. Because it contains two substances necessary for the growth of crops, viz.: sulphur and lime. Different crops contain different proportions of these materials, and here we find one reason why plaster is more beneficial for one crop than another. A clover crop of four tons contains more than forty-nine pounds of sulphate of lime or plaster; while a wheat crop of twenty-five bushels (with the straw) contains less than seven pounds; while fifty bushels corn contain less than one pound of plaster, and with three tons of stalks the crop removes less than thirty pounds of plaster.

2. Liebig claimed that the chief benefit from plaster was from its combining with the carbonate of ammonia of the air and of rain water, forming sulphate of ammonia, which is not volatile at ordinary temperatures, while the carbonate is volatile. In this way plaster has a power of fixing the atmospheric ammonia. This is the explanation we almost always find in the books, but it is not very satisfactory when closely examined. The amount of carbonate of ammonia brought down by the rain varies from seven to twelve pounds to the acre; only a part of this would be volatilized under ordinary circumstances, so that the power of plaster to fix volatile atmospheric ammonia would seem to be small at the best under ordinary conditions.

3. A large number of investigators have conclusively shown that a solution of the sulphate of lime has a peculiar disintegrating influence on the compound silicates of the soil, setting free potash and magnesia for the use of the plant. This result has been found so uniformly by different investigators in different countries, that there could be no doubt on the subject. By a dressing of plaster, therefore, we not only afford the plant a supply of sulphur and lime, but we also afford it the means of obtaining from the soil an increased supply of potash and magnesia. Both of these substances are essential to plant growth, but potash is one of the most important and abundant constituents of the ash of cultivated plants, and without this substance no plant can grow. The influence of potash on plant growth is well seen when wood ashes are used as a manure, and you are all aware how much the vigor of the plant is increased thereby. When we use wood ashes we directly increase the amount of potash in the soil; when we use plaster we render active the potash which was locked up in the soil in the form of a compound silicate, and thus indirectly supply the plant with this important material. By this power of rendering potash and magnesia soluble and active in the soil, we in reality furnish the plant with four very essential constituents of plant growth by the use of plaster, viz.: sulphur, lime, potash, and magnesia.

4. Plaster has a peculiar action on the vegetable matter of soils. All observant farmers have noticed that plaster does not benefit the crop when the soil is

destitute of vegetable mold. Many have also observed that the use of plaster rapidly exhausts the soil of its vegetable matter. All have noticed the dark green color which plaster under favorable conditions imparts to growing plants; also the marked tendency to the formation of leaves and vegetable fibre without a corresponding tendency to the formation of flower and seed. Now these are the characteristic indications of a large dose of ammonia. It is well known that the vegetable matter of soils contains a large amount of combined nitrogen (about two per cent.), but it is what is called inert nitrogen. If this inert nitrogen of vegetable mold were made active, it would afford a large amount of a very important material for the rapid development of the plant.

Placing all these facts together, the question arose in my mind, does plaster afford an increased supply of nitrogen to plants by reacting upon the vegetable mold of the soil, setting free its inert nitrogen in an active form? To test this matter I weighed out two equal quantities of the same swamp muck, placed one in a given measure of solution of plaster, the other in the same quantity of pure water. These two specimens were placed side by side, stirred up occasionally, and after a week a quantity of water was filtered off from each, and the solutions carefully tested for ammonia. This experiment I have repeated, and with results nearly uniform. The plaster water always gave decided indications of ammonia, while the pure water with muck either gave no indications of ammonia or very feeble ones.

From the similarity of effects on plant life of plaster and ammonia, from the fact that plaster is without such influence in the absence of vegetable mold, and from the fact that solution of sulphate of lime sets free ammonia when brought in contact with vegetable mold, I am led to believe that one of the most important properties of plaster is its power of making active the inert nitrogen of the vegetable matter of soils.

LOSS BY DRAINAGE.

We must not close our consideration of this subject without calling to your mind the important fact that a good deal of plaster is every year removed from the soil by the action of water. Plaster is a comparatively insoluble material, but it dissolves in 500 parts of water. In consequence of this solubility, and of the fact that the soil has no power of fixing this substance in an insoluble form, all river water in this State contains this material, and it is constantly being washed out of the soil. While the amount of plaster held in solution in any small specimen of water is small, yet the aggregate thus removed by our rivers is large. A small stream flows through the college grounds, which is dignified by the name of Cedar river. I have measured the stream and estimated its average flow, and the amount of plaster it holds in solution. I find the stream 80 feet wide, two feet deep, and the flow two miles an hour. I made two separate estimates of the amount of plaster held in solution in a cubic foot of water: by the first estimate it held 13 grains in each subic foot; by the second estimate, 12.9 grains. These estimates agree very closely. But during the spring floods the river water will contain less plaster than I have estimated. Let us call the average ten grains of plaster to the cubic foot: how much plaster will this small stream annually carry away from the small section of this State which it drains? More than ten thousand tons a year! If this small stream carries off such an enormous amount year by year, how much will all the rivers of our State remove yearly?

You may ask what becomes of all this plaster? It is carried finally into the

all-devouring sea, where it will finally be deposited in new plaster beds; and when these are again brought to the surface by some volcanic upheaval, your ever-so-many-millionth grandsons will wonder where so much plaster came from, and they will use it to enrich their fields, which will then be undergoing a like process of exhaustion by the solvent and transporting action of water.

I close this lecture with a recapitulation of the action and benefits of plaster as used in agriculture.

1st. Plaster acts best in dry soils and in moderately dry reasons.

2d. It is inactive, or at least fails to give the best results in soils deficient in vegetable mold.

3d. It tends to dissipate the vegetable matter in soils by promoting oxidation.

4th. Plaster benefits plants by directly supplying sulphur and lime, and by indirectly supplying potash and magnesia.

5th. It *fixes* or converts the volatile carbonate of ammonia into the non-volatile sulphate of ammonia. Its office in preventing the waste of carbonate of ammonia in the stable and in fermenting manure is much more important than in fixing the ammonia of the atmosphere.

6th. It increases the development of leaves and stalks, without a corresponding increase of seed. The most careful experimenters assert that it is of no benefit to cereal crops.

7th. It is markedly beneficial to clovers and all leguminous crops.

8th. As plaster is of sparing solubility in water, a comparatively small dressing is as beneficial as a very large one. A hundred weight is as good as a ton, so far as the crop is concerned to which it is applied.

9th. Since plaster is rapidly washed out of the soil by the heavy rains of fall and spring, it is best to apply the plaster to the crop we wish to benefit in the quantity which that crop requires, and at the time it is found to do the most good, viz.: in early spring growth.

10. There is great diversity of views among farmers in regard to the influence of plaster on Indian corn. Although corn ranks second or third as a market crop, yet for use upon the farm it stands first in importance among our grains. All doubts in regard to the influence of so important a manural substance on a leading crop should be solved by accurate, careful and repeated experiments by farmers in all parts of the State.

DISCUSSION ON PLASTER AT ADRIAN.

J. Hoag.—In regard to liberating the extract of ammonia from muck or soil, does it operate the same on manure?

Dr. Kedzie.—It only produces decomposition of the manure, and acts as a means of catching the ammonia and holding it.

H. C. Bradish.—In your opinion would not pulverized muck have very much the same effect as plaster?

Dr. Kedzie.—As far as catching the ammonia it would have the same effect.

Mr. Moore.—I have been at a great loss to find any material difference or benefits from plaster, whether applied in small or large quantities. I have used it of late years on my corn crop, and I have always thought with the best results. I shall have to try by thorough experiment before I can be convinced that it does not increase the yield of grain. I know that it increases the growth of stalk, and I am pretty well satisfied that it increases the seed. I have received the largest benefit on clover. I have experimented in the use of plaster on this crop, in different ways. I have used a bushel, bushel and a half, two bushels, a half a bushel, and a peck to the acre, and there was no marked difference, and then I have used none at all and there was a striking contrast.

J. M. Roberts.—I would like to ask if you have ever experimented with your corn by leaving a part without plaster.

Mr. Moore.—Yes, sir; I have done that with very marked effect. I have also mixed plaster with ashes and received very large benefits.

Dr. Kedzie.—Have you ever measured the bushels of corn?

Mr. Moore.—No, sir; but the effect was very marked where I used it on the hill.

J. M. Roberts.—I have tried plastering ten rows and skipping ten, and I could never observe any difference.

J. H. Green, Raisin.—I am decidedly a plaster man. I think I have seen the best results from its use both on corn and clover. I have never measured the corn, but there was a material difference in the growth of the stalk, and I have always observed that where you have a large stalk you generally get a large ear. I have also used it where I know it increased the yield of wheat, not only in quantity but quality.

Mr. Moore.—I can say that I have lived on my farm twenty-two years. When I moved on the farm where I now live twenty-two years ago, I was told that my land would never raise grass. The first year I was on the farm, all the hay I cut on the farm of two hundred acres I put on a scaffold over the stable in a thirty by forty feet barn. I went to work, plowed the farm all over at a good depth, and went to using plaster. I would plow my clover under, and I have found no trouble to raise two and a half tons of the clean timothy to an acre. My land is in a great deal better state of cultivation than it was twenty-two years ago, and my neighbors will all admit that none of them raise more corn to the acre than I do. I have raised year after year over one hundred bushels to the acre.

Dr. Kedzie.—There is no question in my mind but plaster will increase the growth of the stalk, but I have seen no proof that the yield of grain is increased.

L. C. Drake.—I would like to use plaster on my young clover when it gets two or two or three leaves, but I am afraid that it will injure the wheat by making it later ripening and more inclined to rust. If it will not do so I would be very glad to know it.

Dr. Kedzie.—I do not think your wheat will be injured by the use of plaster.

J. M. Robertson.—I have had an experience of forty years in this plaster matter, having used it on corn, clover, and wheat, and I do not think I have received any great benefit excepting on clover. It has a very marked effect on that. The true way to get substantial benefit from the use of your plaster is to sow it on your clover, and when the proper time comes turn it under. This will improve the condition of your land, and in that way you can increase the yield of grain. Two years ago I plastered a portion of my cornfield, and a part I did not. All through the season you could see a marked difference in the growth of the stalks, but when we come to husk it there was no difference in the yield of the grain. This year I said to my hired man and son, "We will keep the plaster off." We did not put any on, and I never had a finer crop of corn in my life. It yielded one hundred and twenty-five bushels to the acre. My soil is a sandy, gravelly loam.

DISCUSSION AT COLDWATER.

I. M. Sellover, Coldwater.—What amount is best to sow?

Dr. Kedzie.—Just as much as will become active. It is usually found that 100 pounds to the acre has as good an effect as 1,000.

Frank Humphrey, Saline.—Would you apply plaster to muck?

Dr. Kedzie.—If I had simply a muck bed I should not expect any special benefit from the use of plaster. Plaster has but little effect on marshes or wet ground.

F. M. Holloway, Hillsdale.—I have a little pet theory about the use of plaster, and I will briefly relate an experiment which I made. In the fall of 1869 or 1870, I am not positive which, I made an experiment on a field of wheat which had been a clover sod. There were 13 acres in the field. I put 30 loads of sheep manure on one acre, ten loads of the same manure to the acre on five acres more; four acres of it I sowed with plaster at the rate of 400 pounds to the acre, one acre I put on 300 pounds of superphosphates which I obtained at Detroit, one acre I put on ten loads of unleached ashes, mixed with four loads of manure taken from my hen house, and the remaining acre I left in the state it was when turned over. After the manures were spread I harrowed thoroughly and then sowed my wheat at the rate of one bushel and ten pounds to the acre, drilling the ground both ways and sowing half each time. The soil was a dry loam, and seemed to be the same all over the field.

Now for the result. The acre on which the 30 loads of sheep manure was spread cut 56 dozen heavy sheaves and yielded 31½ bushels of wheat. The berry was considerably shrunken and of exceeding dark color. That with the ten loads of manure to the acre gave 22½ bushels. The four acres with the 300 pounds of plaster to the acre yielded at the rate of 26 bushels to the acre, of extraordinarily nice berry. The acre which had on the superphosphates yielded 24½ bushels, of nice quality, fully equal to that which grew on the plastered portion of the field. The acre that had no manure yielded ten bushels. The acre which had the ashes and hen manure yielded 28½ bushels of as nice wheat, I think, as was ever put in a half bushel. The land on which I made this experiment was originally a white-oak opening.

I also tried an experiment on a crop of corn which grew alongside of this very field of wheat on which I experimented. One-half of the field I plastered twice, and on the other half I put none. From the plastered portion I husked eighty baskets, and on the unplastered portion I husked fifty baskets to the acre.

Dr. Kedzie.—It is such experiments as these, which take place in your every-day life, that we wish to call out. This increase of grain by the use of plaster is different from the results of experiments made in France, and the experience of the farmers of Van Buren County.

Mr. Pestle, Quincy.—Two years ago my hired man aided me in sowing plaster on my wheat, and for the first two or three acres he only put on about forty pounds to the acre where I put on one hundred. I am confident that I got one-third more wheat, and of a nicer quality, where one hundred pounds was used.

I. M. Sellover.—I think if the seasons were all alike, just so warm or just so much rain, we could arrive at some definite conclusion about the use of plaster; but under the present order of things I don't think we can tell.

C. G. Luce.—I have used plaster for many years, and have tried it on my corn by plastering ten rows and leaving ten rows; and I don't think I ever increased the yield of corn a single kernel. My land is a dark, gravelly loam, or burr-oak plains. While the use of plaster on wheat will sometimes increase the growth of the straw, I think it more likely to rust. My experience is that plaster never helps a man's grain crops until it has helped his clover. It depends something on the kind of soil, as to how plaster will affect the growth of the stalk.

EDUCATION—WHO NEEDS IT? WHO CAN AFFORD IT? DELIVERED AT INSTITUTES IN ALLEGAN, DECATUR, AND ADRIAN.

BY GEO. T. FAIRCHILD, PROFESSOR OF ENGLISH LITERATURE.

The theme, education, is a well worn one, occupying the thoughts of scholars since the establishment of schools, long before the Christian era. To give a list of great men who have written upon it might take the whole of my allotted time. But for most of all these centuries the term has meant only learning for the few to whom birth, or wealth, or leisure gave especial facilities for study as opposed to practical pursuits. So the wisdom of the ancients does not meet our wants.

Nevertheless, in our day, when all the civilized world has drifted into the belief that the strength of a nation is in its schools; and in our country, where all advocate popular education in one form or another, there seems no room for debate, and hence no room for interest in such a subject. Perhaps it is so, but sometimes it happens that two cronies, sitting down to converse tamely upon their common faith in, it may be "saint's perseverance," or it may be "falling from grace," soon find themselves in hot dispute over the meaning and importance of the very terms. So settled, as we all are, in the conviction that general education is the source of national peace and prosperity, and of most of the comforts of civilization, we, friends of education, find abundant interest still in debating its meaning and limits, its aims and ends, its means and methods.

While, then, this is no place for a general outline of the various notions, it is not superfluous work to define this word, which, in every body's mouth, has such varied meanings. Let education be a training of the mind to think, whenever thought is needed, with clearness of perception and energy of attention. Here we must distinguish it carefully from two of its relatives: knowledge, which furnishes the materials and tools with which thought builds; and skill, which is the particular application of some particular knowledge to some particular end. I may have stores of knowledge beyond the comprehension of all my neighbors, and still be helplessly incompetent to use it, just as the hardware dealer knows the name and the purpose of a thousand tools that he handles, but never uses. Such knowledge is gained by applying memory to facts which we come in contact with through our senses, sometimes with and sometimes without the aid of other men. The cultivated memory that retains them is but a small part of an educated mind. Just as essential as the kit of tools to the carpenter, this knowledge serves in the same way: that is, when it is well used. Without the sharpened intellect, quickened perception and accurate reasoning that are the outgrowth of mental discipline, the verk bulk of one's knowledge may be a burden to him; but thinking the right thought in the right place he can apply his knowledge to a thousand useful ends.

As one of our ablest Senators (Hon. Wm. L. Webber) recently expressed it: "The fact is that education does not consist alone in acquisition of knowledge. It consists rather in giving the scholar a well-disciplined mind, teaching him independence of thought, self-culture, self-control, and self-reliance. He must have the power of making use of knowledge, turning it to practical results, or it does him little good. His acquisition of knowledge fails to make him an educated man, unless it brings these results. Education is not taken as one

would take his breakfast. You cannot make an educated man as you would fat a turkey,—by cramming him."

The thoughtful Locke, almost two hundred years ago, expressed the same conclusion in this way: "Those who have read of everything are thought to understand everything too; but it is not always so. Reading furnishes the mind only with materials of knowledge: it is thinking makes what we read ours. We are of the ruminating kind, and it is not enough to cram ourselves with a great load of collections; unless we chew them over again they will not give us strength and nourishment."

Turning now to the other extreme, a training in the technical use of knowledge in some trade or craft is not education worthy the name. I may have all the skill of the puddler in the iron-mill, or the more delicate expertness of a glass-blower, and remain as uneducated as the machine that may yet take my place and do more perfect work than I can. We all know that men of most consummate skill are sometimes least capable of showing themselves men, when occasion calls for action outside of their established routine. Theirs is a training such as you can give to a horse, or such as has now and then made famous a learned pig; it cannot form the basis of training for manhood and citizenship.

Nor is education to be sought in a simple combination of these elements. The truly practically educated man has other sources of power as well. While the knowledge and the skill are eminently practical in the control of an educated mind, and every thinker needs them, we must not feel too sure that the acquisition of these gives the culture needed to use them to best advantage. We may become more skillful workers, but the trade that enables us to earn our way in the world, however essential, is but a very small part of the art of living well. Says Superintendent Payne, in his recent work on School Supervision: "The most useful, the most truly practical art which can be acquired, is that of reasoning dispassionately and accurately upon all questions which come up for solution in daily life; yet it is certain that the studies which best furnish the mind with this ability have but little direct use in those employments whereby the masses of mankind earn their daily bread." How all-pervading is this reasoning, touching every practical question of life, any of us here can testify.

Doubtless we shall all admit that the most practical education is that which aims to cultivate the most practical good sense, however we may differ as to the value of certain studies or methods of teaching. In this direction we have had, during the last twenty years, a crusade in behalf of so-called practical studies. It was needed, no doubt. The conservatism of long-established routine had overlooked the growth of new fields of study, more enticing, more suggestive of thought than the old worn paths, and more direct roads to comfort and enjoyment in life's work. But, in taking advantage of this grand opportunity for joining our work and our wisdom, let us not drift to the extremes of mere useful knowledge or mere training in a routine drill for the trades. Both are necessary; how necessary, I cannot stop to tell; but the one makes a cyclopædia, and the other, a machine, while both combined fashion us into something less than man, the rational being.

How much time may well be devoted to this proper training of the mind to think, it may not be possible to decide for all places and circumstances. The whole question is relative to the degree of civilization enjoyed by us all; for as knowledge widens, our relations to the world about us increase, and the culture needed to cope with all these relations successfully must be equally enlarged.

But, in the topic selected for this discussion, an average limit is suggested by the very questions asked, and I propose, in answering these questions, to call that an education, which may be gained in a four years' course of academic study so contrived as to insure prime attention to discipline of mind. A longer course and more extended research may be the average limit elsewhere, and in future days we may find the longer apprenticeship for life's work desirable; but in this day's struggles with nature, and with our work urging us daily, we can scarcely wait for even so much as four years of training. The most of us do not wait, and mourn that we cannot, perhaps, or at least wish that we had the leisure for a culture which we admire and almost envy. For all these I propose the two questions of my theme, after pointing out what we are talking about, and if the answer to the first somewhat forestalls the second, let us not be disappointed, for what we really need we can afford.

The first question is, "who needs this symmetrical training to think?"

Perhaps all are ready at once to answer; yet it will do us no harm to spend a few moments in looking it fairly in the face as put to each of us. A few general principles may help us to see the real necessities of the world and of ourselves.

First we have the universal demand of the race for cultivated men. You and I need that somebody should be educated, that the world may not drop back into barbarism and drag us with it. Would it not be better to say, we need to be educated, that we may aid mankind in the struggle for progress? —we need education for philanthropy's sake? We all know how the world for us has come out of darkness into light, out of want into almost luxury, making us the "heirs of all the ages; but we do not always think how each step in the advance has been along with, if not the direct result of, somebody's mental training in youth or early manhood. Otherwise, "wisdom comes only with age when we've no use for it."

To undertake to give the part which educated men have had in this progress would be to attempt a history of civilization complete, which no one has yet written. Those who have given us a limited view have felt this truth, that individual mental growth attends each advance. Guizot says, "If we now examine the history of the world, we shall find that every expansion of human intelligence has proved of advantage to society." He accounts for the fact, too, saying, "when a man acquires a new truth,—when his being in his own eyes has made an advance, has acquired a new gift, immediately there becomes joined to this acquirement the notion of a mission. He feels obliged, impelled, as it were, by a secret interest, to extend, to carry out of himself, the change, the melioration which has been accomplished within him." Buckle, another noted writer in the same field, sums up his conclusions thus: "For as we have clearly seen, the advance of civilization depends solely on the acquisitions made by the human intellect, and on the extent to which those acquisitions were diffused." To guard us against mistaking the character of this acquisition, he says, "Real knowledge, the knowledge on which all civilization is based, solely consists in an acquaintance with the relations which things and ideas bear to each other and to themselves; in other words, in an acquaintance with physical and mental laws." "The business of education," he continues, "is to accelerate this great movement, and thus increase the fitness and aptitude of men by increasing the resources which they possess."

Thus one great student of the world's progress finds it to depend on either individual culture or social freedom, each reacting to produce the other; while

the other finds it all in the cultivated intelligence reaching to the masses. Let us trace through some of the great landmarks this course of advancement, just for a suggestion of the place occupied in it by educated men.

Of literature, the storehouse of knowledge and its instrument of power, I need say nothing. We all know that in all particulars it has sprung, with rare exceptions, from the men of previous training. It takes a Shakespeare and a Burns to prove the rule.

In general morals there is scarcely the needed exception, unless we count the advent of Christianity such. The great reformers have been men of culture, who appealed to reasonable creatures through their trained abilities. Among the Hebrews, from whom we have the fullest record of such movements, it was first Moses, "learned in all the wisdom of the Egyptians," who taught them the decalogue, "the whole duty of man;" next, it was Samuel, trained from babyhood in the chief school of his time, who brought back Israel from the corruption of Eli's sons; and so all the way down. If Christ and the twelve apostles had no intellectual training, Paul, to whom we owe the spread of the gospel to Europe, was especially a scholar. Luther's long course of training in school and college made him the leader he was in the great reformation; while Calvin's rigid faith is still a power in the world, because his full culture enforced it. The English Wyckliffe and the Scottish Knox both sustained their truth-loving zeal by full discipline of mind. Even minor reforms find their acknowledged source in educated men. You place the college-trained Wilberforce at the head of the British anti-slavery movement, and you scarcely doubt the eager hours of study after a printer's day's work that placed Garrison a champion in our own land. You are not surprised that John Howard, the inaugurator of modern philanthropy toward criminals, that seeks to make our prisons places of repentance and reform, instead of "hells on earth," was well educated.

Do not misunderstand this. It is not that only the educated are good, nor even that all the educated are good. It is simply that we expect power to do good from the trained intelligence, and have a right to expect it.

In the promotion of stable government sustained by other than military power we find the same class of men at work. I will not stop to trace the progress, but it surely was no accident that the first really well established king of England, to whom is given the credit of forming the country, was the educated lover of learning, Alfred the Great. Is it strange that of the fifty-six who signed the declaration of our independence (a step that the world is celebrating to-day) forty-one were educated men, thirty being regular graduates?

Here, too, we must not mistake the bearing. Many a man has done wisely in government by his innate powers trained in daily experience, but the bulk of the power has been from the limited ranks of the educated. President Hays, of Washington and Jefferson College in Pennsylvania, has given statistics of our own government officers, showing that "a fragment of society, certainly less than a hundredth part," furnishes more than two-thirds of the cabinet officers, thirteen out of fifteen presidents, eight out of nine chief justices, and two-thirds of the associate judges.

If we inquire after the great discoveries that have made the world wiser and wealthier, leaving out the precious metals, which have cost all they come to, there is little that we do not owe to the students whose names are household words. If Franklin is an exception in having had no training in school, he is a still greater exception on the other side in having been a hard student without school. Even in geographical discovery, the plainest of all sailing, the educated

men bear the palm. Columbus, De Soto, and La Salle, who opened this new world of ours, were all trained in the schools of their time.

In the first rough work of pioneer life there seems more call for mere endurance and less foresight; but the number of educated men and women who have made their influence felt even here is decidedly out of proportion with our expectations.

When we look at the work of inventing the practical machinery which seems to have so large a share in the effectiveness of the discoveries almost always preceding, it seems at first that long practice in the work to be done must be the chief element of power here. Economists have naturally inferred this, and undoubtedly there is some ground for the expectation; but it is surprising to find how much education does for the inventor, if we may judge from the prominent, world moving efforts. Making every allowance for inborn genius and daily contact with toil, we have still to thank education. Without stopping upon the early inventions, the origin of which is in doubt, let us begin with James Watt, inventor of the steam engine. His schooling and private study, with a mechanical trade, fitted him for a help to students and professors in the university, within whose limits he long dwelt. There, after mature study of principles and natural laws, he devised the engine and some of its applications. Robert Fulton's success in the steamship was preceded by training, first as an artist, then as a civil engineer, and last in long years of study in science and language, Though George Stephenson, inventor of the locomotive, lacked all the facilities for education, he sought in every way to make up his deficiency by study, and at the same time showed his appreciation of its advantage by spending every spare cent of his earnings to give his son Robert what he himself had lacked. Edmund Cartwright, a clergyman, set the power loom at its work, and Eli Whitney, a law student and schoolmaster, modeled the cotton-gin. I make no mention here of work quite as essential, but more quietly done, that brings all the arts of the chemist in play, bleaching and sizing and dyeing and drying, staining, annealing, extracting, purifying, tempering, and endless other things, because these are less understood, and all their bearings could scarcely be appreciated without fuller explanations than are possible here. The same reason excludes a host of illustrations from the application of mechanical laws too intricate for most of us to appreciate. But we can all understand that the telegraph could not spring from an uneducated brain; and if, as is reported, its benefits are to be multiplied a hundred fold, we shall expect rightly to hear that education preceded the drill which fitted the inventor. Said my college acquaintance, as he unfolded the process by which he had reached this grand outlook, "Invention is a special science, and it needs a long preparation to be able to catch the little threads of thought that are woven into a new machine."

I have dwelt somewhat longer than I would on this province of usefulness, because we are apt to suppose that civilization does so much for us to-day as to make deep and careful thinking unnecessary. Says a young friend, "It don't cost much to be smart nowadays, there are so many helps; books of reference innumerable, machines indefinite, even opinions ready made." But how quickly the world will slide into disuse of all this, and how readily rust will devour it all, unless you and I, some of us, keep up the supply of educated brains that make its use possible. So we, all of us who can afford it need to be educated for the sake of good to our fellow men. The broad principle of philanthopy impels us to it, and the laws of social economy enforce it.

If this broadest principle fails, there is a second that may reach us. True patriotism makes us wish to be educated.

Our government stands upon the united wisdom of its people. Every weak-minded citizen, every wavering, unprincipled citizen, is a weak spot in the fabric. Every time I pin my principles to my neighbor's sleeve, I endanger the stability of the Republic. If his wealth or influence can overawe me in forming judgment, I ought to want the power to see for myself and judge for myself, since the very essence of demagoguism is the craft of one exercised upon the ignorance of the many. We cannot be good and loyal citizens in a broad sense without seeking to train ourselves to think. To shirk this responsibility may one day be just as much a breach of good faith as once it was to run away from the draft. It may be enough to-day that we have learned the elements in the common school, but the time is not far distant when this will be sadly insufficient. Already hosts of the people are demanding larger privileges of training for citizenship, not for private advantage, but for political safety. The most important questions of social reform hang constantly upon the uncertain waver of popular will, and the world sees to what depths ignorance may plunge us all. The very greatness of our republic makes this demand imperative, and it is finding a voice in every State. Hear Prof. Kent of our own university. "A higher education for the laboring classes is one of the necessities which modern civilization is demanding. They have lost their old reverence and fear for those above them; if society is to be saved from constant convulsions, they must be made to see that the hardships of their condition come not from human laws, but from the very constitution of the universe in which we find ourselves." If the educated men are first to make the call for such education, it is not because they feel the pressure first, but their eyes see, and their patriotism sends to the rescue.

There is a narrower principle still that makes us feel the need of training to think. We love our children, and not a parent of us but trembles now and then as he takes his boy upon his knee or fondles his blooming girl, at the responsibility he carries. God give us wisdom to lead their young feet through the safe paths! But God helps those who help themselves; and how can we expect the wisdom which we neglect? Education may not ensure a wise direction of our children by any means, and I know the sad reputation that some seemingly highly-favored sons have gained; but, other things equal, there is no question of its advantage to our skillful guiding of the young.

But let all these pass, and narrow it down to self. Do I need an education to enjoy my own existence?

I answer for myself, unhesitatingly,—Yes. If enjoyment consists in an appreciation of the outside world, of the relations which nature gives, of the powers she has endowed me with,—if a man can enjoy more than an oyster, then an educated man can enjoy more than an uneducated one. If enjoyment is mere absence of wants,—why, better to be an oyster or a sponge, and have done with it. Do we not often overlook this ever-present object of our labor, spend all our best days in gathering means for our gratification, to find at last that we have left uncared-for the very capacity for being gratified? Shall I heap up wealth, that I can use for my own satisfaction only by lavishing it upon my children to their destruction and my grief? This is the sad enjoyment of too many, whom an early education might have taught a wiser use of riches.

Everybody needs the pleasure that comes with thinking, after the time for active doing is past. But that is only a small part of the use of an education

to self in daily contact with the world. The universe means more to us for being able to think about it.

We talk of the wonders of the world, and, in this day of rapid locomotion, most of us go to see what we can of them. We talk of its being a good investment to travel,—a wise way to spend our surplus means. No doubt that enjoyment is of the purest, and we shall all rejoice at the opportunity to be so widely given in this centennial of our nation, to "see the world." But a true education enlarges one's vision both at home and abroad. If his travel is limited, he finds almost a world in a drop of water, and the heart of a child is a never-ending source of pleasure, and instruction, too, to one who can read it aright.

But to some of us there is no satisfaction in mere amusement or mere instruction, and I admit that learning for such a reason must be simply a rather harmless dissipation. The higher truth is, that each individual needs education to make the most of himself. If you, my friend, believe that this life is but a beginning of the days of the years of eternity, and expect to have any thing worth remembering, so as to make the future and the present one life, or the life of one being, you must gain that, however little it be, in the mental and moral training of the present. Even if all of life seems to you only this brief day, you can make it fullest and longest by such a training as I have called education. I do not say happiest also, because I do not think that with such a faith one can be happy at all; but I will say least miserable.

I have said nothing of health as a result, because, if ever a man is tempted to overdo, it is when his eyes are opened by intelligence to the world of work about him, and many a grave of genius is witness to the strength of the temptation. But in the same work and under the same strain the educated man has the advantage over the uneducated. Dr. Kane, of delicate frame, in the hardships of an arctic winter, was more enduring than the hardiest seaman, both because he knew better how to husband his strength, and because he had stronger reasons for wanting to live. It was a well noted fact in our late war, that regiments composed partially of educated men and students from the colleges suffered least from camp diseases, and endured best the long forced marches. The reasons here were the same as in Dr. Kane's case, with the added one, that their culture gave them something to think of to drive away home-sickness, the first cause of many disorders.

Of education as a means of individual wealth, you might rightly expect a word, though many of us are sadly conscious that money does not stay better, if it is sure to gather as well, where the wants outgrow the means. Such discussion may, however, more naturally come under the next question, "Who can Afford it?" and I pause to consider but one more advantage to selfish consideration, and that is what is usually expressed in the word "position."

Positions of usefulness have been already noted as, to an extraordinary extent, gained by the educated; but the same fact holds true of the positions looked upon as the expression of fame, or the crowning of success in life.

Here I may quote again from statistics given by President Hays. He finds that about one boy in every 146 goes to college for either a full or a partial course of study; but, supposing this ratio may make no allowance for natural brightness of the educated, he drops forty-six for stupidity, "and surely," he says, "the remaining hundred will average as good natural talents as those who go to college." In the last congress there were three hundred and two representatives and seventy-three senators, of whom "there ought, if an education is of no special advantage, to be three college graduates in the house and one in

the senate. There were, however, one hundred and thirty-eight graduates in the house and fifty-five who received a less complete education, and thirty-five graduates in the senate, and fifteen who obtained an academical education." Thus two-thirds of the members of congress come from a class comprising less than a hundredth of those eligible to the position. In the doctor's own words, the conclusion is: "If among a hundred thousand men a hundred good places are to be distributed, there will be sixty-six of them to go to the thousand college men in the hundred thousand, while for the other ninety-nine thousand there will be only thirty-four places. In one case your chances are one in fifteen, while in the other they are but one in two thousand nine hundred and eleven."

I had the curiosity to make a similar inquiry into the ratio of education in our own State Legislature of 1875. This, we know, was a farmers' legislature, where only twenty-two of the one hundred representatives in the house belonged to the so-called professions, and politics was less influential than usual. Now, since the comparison was to be between common school and academical training, only those in attendance upon the two courses, as reported in the year 1873, were taken for the basis. The number of boys actually in the common school was just about fifty times the number of young men in the colleges, academies, and high-schools together. Then, of the one hundred representatives, there ought to be ninety-eight of only common-school education, and two of the better educated men. The fact is (assuming the few unreported to be divided as the others), that forty-six had an academic or a college course, and fifty four a common-school one. Yet five of the latter had professional training and study, so that we may very safely conclude that one who studies from three to six years beyond the common-school multiplies his chances of a place in our house of representatives by fifty. By a similar calculation, it is shown that his chances of a place in our senate or in the executive department are multiplied by sixty-six. If we ask after those who win a name, as well as position, the proportion of educated men is still greater.

The means of judging of the effect of education in general business life are not at hand, but from various estimates it seems likely that this last calculation would fairly represent its advantage there. I wish some one having large acquaintance with the leading boards of trade would gather statistics there. With such statistics, I should expect to answer the second question of my theme. Without them, I shall have to appeal to the reasonableness of expecting an education to be a good investment for certain classes of men from the nature of the case, adding the opinion of competent judges. For remembering that this question, "who can afford education?" divides into who can raise the means, and who can wisely invest in it, we may discuss the last part first.

It is almost to be taken for granted that men seeking the professions gain largely by previous training. The nature of their calling makes it reasonable; the demand of the people for educated ministers, lawyers and doctors, and their comparative success, prove it. Eminence is reached, if at all, by the uneducated, at least ten years later in life. So say all who have investigated, and the record of our Legislature of 1875 sustains the estimate for all callings. The average years of those from common schools on entering the House were fifty (50.5), while those of the academic students were only forty (40.7). Now ten years of success gained for the prime of life, when it can be used to advantage, is a large return for a few years of youth and a few hundred dollars invested. So we may feel sure (though, strange to say, less than half our lawyers and

35

doctors find it out until too late to profit by the knowledge), that no one looking forward to a profession can afford to neglect preliminary culture any more than he can afford to forego the special course of study. Though without it he may enter the bar or the practice earlier, at thirty-five he will have been outstripped by those who began later, but with better preparation.

But, you say, all cannot be professional men if they would; there must always be a grand majority to make work for the professionals. Can the rest of us afford to invest in education? I believe most certainly we can.

Taking first the class of laboring men called artizans, we cannot but feel sure that he who fits himself by scientific training to scientific thought, while he does not forget the details of his trade, will accomplish most and get the most pay. Every one knows that the work of so called operatives is at all effective, only as some better educated head is able to direct it for them. A careful estimate places the waste, even now, from ignorance and thoughtlessness at not less than one-fifth of our time, and some place it higher still. President Chadbourne of Williams College says: "It is safe to say that more than one-third of the time and strength of all who labor is spent in vain." Now, education cannot be expected to save all of this waste, but a very little saved yearly would soon compensate for all the cost, and pay its compound annuity through life. If it shortens apprenticeship, as we know it does, it saves the immense waste of material by which each rude hand becomes a finished workman.

I know that many practical men express a doubt of the availability of education for business purposes; but yet very few of the successful ones who have sons care to forego its advantages for them, and wherever a systematic effort has been made to gather opinions of able men in regard to their own business, the advantage of education has been granted, with an estimate that it raises the wages from ten to twenty-five or even fifty per cent. That it has not made a wider reputation for itself may be accounted for by two facts: first, that the call for educated men in the professions has never been fully met, and these seem more attractive fields of labor from being more directly involved in all philanthropic schemes; second, from the fact that education has sometimes drifted away from the active life of the world, so as to shut out all thought of details and lead to a sort of foppishness in learning, that made it fear to soil its hands with work. This last fact has sometimes been laid to the account of the kind of studies pursued, linking our life more to the ancients than to our own peoples; but it seems to me quite as much due to the utter separation from the ordinary life of men, made by the old system of college monasticism. The modern plan gives to the student less of a boy's place and more of the man's, and treats him as a responsible being,—holds him amenable to the same laws of good order that outsiders obey, and puts him on a level with his manhood, not in a forced servility that leads to a shirking of all duties. Twenty years from now we shall see the fruit of this in a higher type of business life.

Now, I do not overlook the fact, that much opportunity for mastering the minutiæ of a trade is lost. Yet an educated man may be ignorant of many things that it would be well for him to know, and still thrive; for give him a motive for knowing and his ignorance will vanish, since he knows where to find the knowledge. If, then, we can join to such mental training the associations that bring before us the active business of the world and interest us in them, every business man and every artisan will find a necessary part of his capital in an education.

If this is true of business affairs and trades, in which the work is, much of it,

reduced to a routine, it is far more certainly true in a farmer's life, where all the work is an exercise of judgment. No other worker has such intricate and subtle laws to deal with as the farmer has; none has calls for clearer foresight and insight; none needs clearer perception of a thousand influences at work: and yet too often he feels that a special training for the best use of his powers is a waste of energies and capital. He even discourages the young man of education from entering his calling, by making him believe that drudgery makes up the bulk of its affairs. But if a larger training can still preserve along with it a taste for farm pursuits (and we know by most demonstrative evidence that it can), there is no reason why the ingenuity developed by education may not add its influence to place agriculture the chief of arts, as it is the mother of arts.

On my father's farm, in boyhood, puzzled to know how the huge gate-post had found its place while I was at school, I asked father who helped him. The answer was, "Mr. Contrivance." It was somewhat of a puzzle still to my small brains, but from that day to this it has been a lesson to me, till I believe that "Mr. Contrivance," well educated, can carry heavier loads than the world has yet lifted.

Such an education as shall help over the hard places in life and fit one to enjoy his labor, will pay the largest interest. Look even now over the field of earnest labor for improved agriculture, and not a few are educated men whose culture helps them to success. If Hon. George Geddes reports crops one-half larger than do his neighbors not under his advice, his mental culture does not injure him, surely,—and there are scores like him. If now and then some rattle-brained graduate turns to agriculture, thinking he can do a large business because of his learning, without the constant and steady growth that comes from attention to details, he fails, of course; but a thousand and one have failed like him, without the learning that made his failure notorious. But there is no need of failure—almost no possibility of failure—to one who takes the earnest work of life with the cool judgment that real education fosters.

Here is the true cure for the desire to find something better than farming: Let a boy see his way to usefulness and success, with enjoyment of his toil, and the native instinct for digging will hold firm. I believe the time is coming, when every farmer's son who expects to own the paternal acres as deep as anybody owns his land, will think the first investment toward such ownership to be in farming his own brains. That so many young men have set out with this provision is gratifying to all who take an interest in real progress. May the way open to extend still wider the means and the desire for education in industrial pursuits.

You see, then, the "conclusion of the whole matter." "Wisdom is profitable to direct," and wherever a man is to be more than a mere tool in the hands of another, his first and best investment is in getting wisdom,—the more of it the better, when it lies alongside his business. Many a man wishes he knew more; did ever one wish to know less? Nor must we forget that while some uneducated men are rich, thousands are paupers because of their neglect of culture, and still other thousands barely live, while the world thrives on their ignorance.

The second part of this question is easily answered. Through the benevolence of good men and the wise foresight of our legislators, a liberal education is within the reach of every one who has good hands and a strong heart to support them. A four years' course of study costs, in our State, from a thousand to fifteen hundred dollars, much of which can be earned as needed by labor of

the hands and by teaching, always open to students. The average expenses of every kind to a recent, and the largest, class graduated at the Agricultural College were but $741.43 more than the wages earned at the College itself. To most of these, this small investment has already returned its interest at usurious rates, in superior position and wages. Others have postponed still farther the returns, that they may make them larger by still better preparation for work.

Now, if this seems to you a special plea for the schools that are asking your patronage, I beg you to review the items, one by one, that make it up, and then to apply the adage, "The proof of the pudding is in the eating." I believe the day is coming when none can afford to forego this culture, when each shall see the profit of the investment, that he himself needs it, his friends need it in him, his country needs it, and the race. So every son and daughter of Adam and Eve, who follow the good old way of founding a home out of which shall grow the future good and great, will find their best outfit and their most productive capital in a well cultivated stock of brains, controlling all material wealth. God speed the day, that you and I may live to see it!

THE THREE INSECT ENEMIES MOST TO BE DREADED BY THE FARMER. DELIVERED AT DECATUR, ADRIAN, AND COLDWATER.

BY A. J. COOK.

The greatest enemies of the farmer! What are they? The history of the past would doubtless answer, ignorance, indolence, and isolation. But to-day intelligence and even culture are no strangers in our rural communities; thrift and energy are no where more apparent; while through the wholesome influence of the club and grange even the moss-grown walls of isolation are being razed to the ground.

To the incautious farmer, who foolishly allows the debtor columns of his account to greatly distance the creditor, perhaps the most dreaded enemies—at least he comes to consider them as enemies,—are the banker, grocery-man, and constable. To the shiftless farmer—and how many there are even here in Michigan,—with fences low, tools unhoused, and stock unsheltered, scarcely worse enemies appear than his neighbors' stock, rust, and rot, and the host of evils which are usually ascribed to ill luck.

But it is not among the bushes and hedge-rows of this broad field, that I am now to go in eager quest, of the farmer's enemies, that I may find them and bind them. It is among those insect pests that pilfer our grains, steal our fruits; tunnel our fruit and shade trees, and utterly destroy our lawns and meadows; that I am to go as search warrants, that I may point out the evil-doers, and indicate the means to bring them to speedy and certain justice. Just here, then, we are to point out those insects from which "disaster, follows thick and follows faster," till the discouraged farmer looks to his wasted fields, and gardens, and murmurs "Only these and nothing more."

About three years since one of the present legislators of Allegan county said to me; what are we to do with the cut-worms? They are *committing* a ruinous *work* in our neighborhood. In fact we have no discouragement that compares

with this. Here then the first enemy of our farmers in its importance—the cut-worms. Last winter the able representative of Van Buren County, Hon. A. B. Copley, and President of this meeting, said to me: "At present we have nothing among the farmers of our county, that causes more solicitude than the white grub, or larva of the May-beetle." Here then we have our second worst enemy, and not second even to the cut-worms, where it is equally abundant;—the May-beetle.

During the past season, I have received many letters from the southern and western counties of the state, containing specimens of the army worms, and statements that they were devastating the oat-fields in an alarming manner. As one man said, playing havoc to the tune of many thousand dollars daily. Here then when it is prevalent is our third greatest insect pest, the army-worm. Hence my subject the cut-worms, May-beetles, and army-worms.

And why are these insects unrivaled in the destruction they cause? 1st. Like the grasshopper army of the west, they come in such exceeding numbers, that to cope with them by artificial means, is utterly impossible. We may abridge their mischief, we can hardly hope to overcome it. 2d. They are so concealed in their work that even natural agents are powerless to overcome them except they receive the aid of man, and thus these are to the agriculturist, what the codling-moth, curculio and borers are to the fruit-grower, though in these latter cases we have good and efficient remedies.

Let us proceed, then, to discuss these worst pests of the farmer separately:

[The matter concerning the first two enemies was essentially the same as that published in the Report of 1874.]

THE BIRDS.

Before leaving this subject I wish to say more in reference to the birds, especially the robin and the blackbirds. During the past season I have observed these birds with great care, not omitting to examine their stomachs, that I might know of a truth as to the exact nature of their diet. I have examined their stomachs for this purpose from April to October, and let us see with what results. I have frequently seen the robins and blackbirds following closely upon the harrow or the plowman. One day last September I scart away a small flock of blackbirds that were following a man that was ploughing, and in going less than ten rods I picked up three white grubs. Many farmers have remarked to me, during the summer and autumn, as to the abundance of these insects on newly plowed ground, and the eager watchfulness of the blackbirds. I have myself observed that the robins were not a whit less active in this same good work, on the newly plowed lawns about the college.

But we have still more decided proofs that these birds are constantly engaged in a work which we can hardly ever hope to accomplish without their aid. Early in the season I found nothing in these birds' stomachs except insects. Through April and May I was delighted as well as astonished to find that they fed largely on these same cut-worms and white grubs. It was not uncommon to find two or three of these larvæ in a dissected stomach. Nor did these birds stop here, but they sought out these same grubs and caterpillars for their nestlings. Now when we consider the rapidity of the young robin's growth, and the two or three annual broods, we can more justly appreciate the good accomplished by these birds. In summer and autumn they continued the same good work which early was supplemented by a dessert of corn and cherries, though later our red-legged grasshopper, *Caloptenus femur-rubrum*, was scarcely ever

absent from their digestive canal. This grasshopper, which is scarcely to be distinguished from the *Caloptenus sprætus*, or destructive grasshopper of Kansas and Nebraska, has been often quite destructive in our own and other States of the east, and were they as numerous, they would be as dreaded as their western relatives. Remove *our* birds—and none are more meritorious in this respect than these same robins and blackbirds,—and we would have as good reason to cry for aid as our less fortunate brothers of the west. The treeless plains of the west are not attractive to the birds, hence the usual balance of nature is not maintained. In other words the insects have the long end of the lever. It is a safe assertion that our fellow citizens of Kansas, Minnesota, and Nebraska are building better than they know in setting out trees. Tree-planting will be to the west what forest preservation will be to us,—her salvation.

Is it not a significant fact that in the west and southwest of our State, where fruit culture is a specialty, and where the entire preservation of the small fruits can only be gained by a thorough destruction of these birds,—there the perplexing problem arises; What can we do to prevent the ravages of the cut-worms and white-grubs? A few years ago, the venerable Dr. Kirtland of Cleveland, Ohio, a man no less distinguished as a pomologist than as a scientific scholar, said to me, "I have been a close and untiring student of birds, and that too in a practical sense, for over seventy years, and my experience and observation, would lead me to plant cherry-trees and grave-vines to attract the birds, and not to destroy the birds to save the cherries and grapes.

Said Mr. C. Engle, the celebrated fruit-grower of Paw Paw, Van Buren County, to the orchard committee of the State Pomological Society for 1874, in response to the question: How do you manage to protect your cherries from the birds? "I kill them. I have no more hesitation in killing a bird for the same reason than a curculio, the laws of the State to the contrary notwithstanding." Said Hon. A. B. Copley to me the following winter, "What can we do to exterminate the white-grubs? They are doing incalculable damage." Now we can raise small fruits, and still protect and foster the birds. We can not raise grain and grass, in presence of the white-grubs. As yet we know no method, other than through the agency of the birds, to destroy these insect pests. And foremost among the ranks of this valuable army, stand the robin and blackbird.

Another fact which I have ascertained by my summer's experience gave me no little surprise and gratification: which is that these birds seldom feed on beneficial insects. I scarcely ever found either parasitic or predaceous insects in their stomachs. Such welcome discrimination is not so difficult to explain when we remember that such insects very often give off a very pungent odor, which very likely was given for protection.

What, then, is our policy in the premises? Undoubtedly to make our plantations of small fruits so ample that we shall feel to welcome the birds. As in many other cases, our laws are at present ahead of our practice; yet here as elsewhere we may expect that very soon a better knowledge will lead the people to appreciate the excellence of the laws.

THE ARMY WORM.

Leucania unipuncta, Haw. Sub-Order—*Lepidoptera*. Family—*Noctuidæ*.

During the past season the southern and western part of our State, and the regions south, south-west, and south-east, have experienced one of those strange

visitations which were so long inexplicable except as tokens of Divine vengeance, called forth by man's iniquity,—an army of devastating insects. And though the superior intelligence of our day no longer recognizes this as the result of an offended Deity, but as the natural sequence of those wonderful yet harmonious laws which govern the animal kingdom, still the observations generally made during the last season in reference to the army worm were characterized by absurdities but little less glaring, and indicate that even yet there is a general ignorance about common things which is far from complimentary to our present system of instruction.

In their plan of attack, immense numbers, and serious despoilation, these army worms bear striking likeness to the noted grasshoppers of the west and the far-famed locusts of the orient.

This is not the first time, either, that Michigan and the northern part of our country generally, have been inflicted with this plague. Many of you will remember a similar raid which occurred in 1861, while history informs us that still earlier attacks at long intervals were experienced in New York and the New England States. And what gives to these phenomena an unusual interest is the fact that, even though these caterpillars come in myriads, the very next year they will not be sufficiently common to even attract notice. Such an anomaly in insect habits certainly calls for explanation. Let us, then, trace the natural history of these insects, examine closely into their habits, and then see if the strange problem of their erratic course is capable of solution.

NATURAL HISTORY.

FIG. 1.

The moth (see Fig. 1), though not very showy, is quite attractive. The color is an indistinct yellowish brown. There is a central white spot on the primary wings, with an oblique row of black dots near the extremity, and another similar row midway between this and the white spot. The secondary or back wings are dusky, bordered with a lighter band. It is nearly an inch long, and expands about two inches. These moths, like nearly all of the family, are nocturnal, remaining concealed by day, and are attracted both by lights and sweets. I have seen as many as twenty at a time on a board a foot square, sipping away at syrup which I had previously spread on purpose to attract moths. Upon the least disturbance, they would dart forth, looking not unlike snowflakes as they flitted about my lantern.

I took the first moths on the night of the 17th of August. They continued to appear, and in two or three days became very numerous, and remained so till the middle of September, when they commenced to grow less, though I took them occasionally during the entire autumn. I have taken these moths at Lansing every autumn for the last eight years, though in limited numbers. This fall they were the most common of our moths, and yet we were not troubled at Lansing with the larvæ,—the so-called army-worm.

Hence at Lansing, Michigan, it is safe to assert that the eggs are laid in the months of August and September. As we go south we should expect the egg-laying to occur earlier, and observation has sustained our inference, as the moths have been observed even six or eight weeks earlier in southern Illinois and Missouri.

WHERE ARE THE EGGS LAID?

I do not know as anybody has ever seen the eggs laid, or found them in position after they were laid. Yet in this case analogy is nearly as satisfactory as actual observation; and analogy points to the stems of plants of the grass family and the sedge family as the place of deposit. We find that instinct, that mysterious faculty which puzzles even the wisest philosophers, impels all insects to place their eggs on or near the food which their young or larvæ are to feed, even though this food has no part in the diet of the mother insect. The wasp sips the honeyed sweet of flowers, yet she never forgets to place her egg in the captured grub or caterpillar which she has imprisoned in her earthen cell. Our common house-fly has a taste which the veriest epicure would respect: yet her eggs are placed in the filthy ordure of the horse-stable; and as you all know, the potato-beetle lays its eggs on its food plant, the codling moth on the apple, the curculio on the plum and peach, the various borers on the trees which are fitted to nourish their young, and so on of the whole order. Mistakes, which would certainly prove fatal, we have every reason to suppose are of very rare occurrence. Hence, as we know that the larvæ of the *Leuconia unipuncta* —the so-called army worms—feed on the plants of the two families Gramineæ and Cyperaceæ, or the grass and sedge families, we are safe in asserting that the eggs are laid either on the grasses, which include our common grains, as wheat, barley, oats, and corn, or the sedges, which are generally known as wild grasses. Both Professor Riley and Dr. Fitch think the eggs are usually laid on plants which grow on low ground. I have some doubt if such discrimination is practiced. The eggs remain as such not only through the autumn, but also through the next winter, even to the next June. I am speaking for Michigan.

LARVÆ.

The young caterpillars (see Fig. 2) come forth from the tiny eggs during the last days of June. These are black striped with yellow, and bear a close resemblance to some of our common cut-worms. Their appearance changes but little with growth, except in their ever increasing size. When fully matured they are about one and one-half inches in length. I need hardly say that these caterpillars have the usual number of legs, six true, and ten false ones.

FIG. 2.

These larvæ develop in about four weeks, but are not seen except in such seasons as the last, when their excessive numbers attract general attention. Even when they are so numerous they are seldem noticed till after they are at least half-grown. At this stage or later, their food plants are swept away as by fire, and thus these larvæ migrate in armies whose numbers defy computation. Roads are covered with a living carpet, which if not three-ply is three deep. Railroad trains are stopped and whole fields of grain vanish in a night. I remember in 1861 to have seen such an army cross a lane. It was impossible to pass along, without crushing myriads of these caterpillars. Fences were entirely covered, and though this was at five oclock in the afternoon, still an eight acre field of oats, which they were just charging upon, was entirely ruined

during the night. The morning witnessed nothing but naked stems. So too this year in the southern counties of our State, hundreds of acres of oats were ruined by these hordes of destroyers. And though our State for the most part wholly escaped injury still these destructive raiders were very general in their work of pillage, as we read account of their havoc, even from Massachusetts to Missouri.

We thus see that the word army-worm is no misnomer. The same word is applied to another closely allied insect which plunders the cotton-grower of the south.

After the completion of their four weeks' glottony, the caterpillars having now completed their growth, descend into the earth for about two inches and become pupæ (Fig. 3). As before intimated, this occurs during the month of August. In about three weeks the moths again come forth to mate, and in turn lay their one or two hundred eggs.

FIG. 3.

WHY THEY COME IN SUCH NUMBERS.

Prof. Riley and Dr. Fitch think that they usually feed and dwell in marshes, where they are confined, but that excessively dry years are very favorable to their increase, so that many moths will be developed, and a corresponding number of eggs deposited. They also believe that a very wet year favors the growth and development of the larvæ, so that when we have a very dry year succeeded by one very wet, then we may expect raids from these ruthless destroyers.

The experience of the past two years, as well as the previous cases carefully elaborated in Dr. Fitch's 6th Report, seem to sustain this view. Yet it may be, and I incline to the opinion, that the peculiarity of the seasons has no such direct agency in producing these unwelcome results. I have found that in common seasons I am quite as apt to take the larvæ of these moths in sweeping the grass of high lands with my net as in sweeping the same in low or marshy places. I believe that these insects would develop and lay eggs, whatever the season, until they should sweep such plants as they feed upon out of existence, were it not that nature, Malthus like, interferes to check the increase.

That great philosopher and naturalist, Charles Darwin, has well shown that there is a great struggle for life, in which the weak are overtaken and destroyed by the strong. Now this constant warfare extends with superlative rigor to the realm of insect life. The principle, though a general one, is best illustrated among insects, since they so far outnumber all other animals. As Swift well says:

> The little fleas that do us tease have lesser fleas to bite them;
> And these again have lesser fleas, and so *ad infinitum.*

Now the army-worms, perhaps from ease of access, having no means for concealment, are emphatically victims to this principle. In fact, though hundreds of these larvæ were sent me the past season, still I did not rear a single moth. Nearly all were so exhausted by living foes, eating their very substance, that they even failed to pupate, and the few that did transform to pupæ were only a little later in succumbing to the hungry parasites, which found their sleek, full-fed bodies both home and food. But though I did not rear any of these moths, I did rear millions of the tiny parasites, through whose active labors these far larger insects, our dreaded pests, were brought to naught. I thus obtained no

FIG. 4.

less than four species of insects that were parasitic on the army-worms. Two of them are nearly allied to our common house-fly, which they much resemble, one being nearly as large (Fig. 4) and the other only about half as large. The other two were tiny Ichneumon flies. These latter insects, after completing their growth in the larva state, in which they much resemble maggots, came forth and spun their small white egg-like cocoons, fastening them either to the caterpillars or to the plants, and from these issued the tiny Ichneumon flies (see Fig. 5). So common were these cocoons that I had large boxes full of them sent to me from Monroe, Lenawee and Branch counties. Many supposed that they were the eggs of the caterpillars, and asked if they should be destroyed. Of course I returned a vehement *no,* written in Italics, underscored and followed by indefinite exclamation points. Were these to be destroyed, the farmers' best friends would be sacrificed. The amount of good done and money saved to us annually by these numerous parasites is beyond computation, and if stated would stagger belief. Again, insects as larva never produce eggs. Reproduction is only provided for in the last stage. Is it not time that some of these common principles of animal economy, so well understood, and of such great practical importance, should be taught in our common schools, that such costly, unnecessary ignorance should be driven from among us?

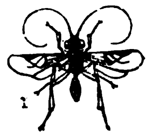

FIG. 5.

Hence we see why these insects which occasionally come in myriads are usually held in check. They are devoured by those of their own order. That they occasionally come in armies is only to be explained in the fact that these parasitic insects are, by some means not fully understood, held in check. If, as Dr. Fitch's researches seem to indicate, a dry and wet season always precedes such invasions, then may it not be true that such seasons are in some way destructive to these insect foes of the army-worm?

WHAT SHALL WE EXPECT?

From the experience of the past, as well as the innumerable parasites of last year, we have every reason to believe that those localities which suffered last year will be exempt from damage next year, and probably for several years. I think we may hope for general exemption, though from the great numbers of moths caught at Lansing last fall, I should not be surprised if the plague was felt there next year. Should this prove to be the case, it would be well for each county to trap for moths each autumn, and if the *Leuconia unipuncta* were unusually numerous, to burn old meadows and marshes the succeeding fall or spring, thus destroying the eggs,

If it were at all probable that these destroyers would continue to come in force, I would proceed to detail the methods to circumvent their mischief. As we have every reason to hope to the contrary, I will only say that a furrow turned away from a field, or, better, a ditch dug along the side, will detain the caterpillars, so that by firing a winrow of straw heaped above them we may practice a very excusable, and quite as desirable kind of cremation.

We have here a graphic picture of the noble work wrought by our insect benefactors, and I am sure that it has not entered into the mind of man to conceive the length and breadth of their good work. Were it not for beneficial insects and birds, our world would soon be a barren waste and uninhabitable desert.

DISCUSSION AT DECATUR.

E. Durkee.—At what time do the cut-worms, which work in the corn, lay their eggs?

Prof. Cook.—I can hardly answer that question, as there are four or five species which attack the corn, and they lay their eggs at different times. Most of the eggs, however, are laid in July and August. They hatch soon after being laid, and become half an inch in length before autumn. It is probable that the larvæ feed almost entirely upon the roots of the grass.

Mr. Durkee.—Do I understand that the eggs are laid in any place except where there is grass?

Prof. Cook.—I think not. Insects know where to put their eggs so their larvæ can get food.

E. Durkee.—What I call the cut-worm is a small black worm that works in the corn. My idea is that they hatch out in the spring. I don't know whether I am correct or not.

Prof. Cook.—You are not correct.

Mr. Durkee.—Why I think they hatch in the spring is because I see three or four different sizes; some of them little bits of fellows. A year ago I planted a piece to corn where the previous year there was not a weed nor a spear of grass, but they got the start of me for all that, and ate up about nine-tenths of my corn. There were twelve acres in the field.

Prof. Cook.—I will say that these larvæ are capable of crawling quite a distance. Was there a meadow near?

Mr. Durkee.—There was a meadow adjoining.

Prof. Cook.—These larvæ must have lived on the roots of the meadow during the fall, and then crawled onto the field. I have watched them in a patch at the college, and they would crawl nearly a rod in a minute.

Mr. Durkee.—I still think they hatch in the spring for I find these little bits of fellows in my corn.

Prof. Cook.—I think you must have the white grub and the cut-worm confounded.

J. R. Hendryx.—I have never had any trouble from the cut-worm when I plowed in the fall.

J. J. Woodman.—As the Professor was going through with his lecture, I thought I saw a remedy for the cut-worm, which is the pest of Van Buren county. I have resorted to fall plowing sometimes with benefit,—in other cases have received no benefit. The idea struck me to-night that if the theory is correct that the egg of the cut-worm is laid upon the grass and hatches in the fall, a sure remedy would be to plow early, and destroy the grass before there is any chance for the egg to be deposited. But if the theory is correct that the worms do migrate, then my idea of early plowing as a remedy goes for naught.

Henry Chamberlain.—I wish to say that my experience would uphold the theory of Prof. Cook. As a general thing I have not been a great sufferer from the ravages of the cut-worm, but in the season of 1874 their ravages were quite extensive in my vicinity. My soil is a clay loam. One field was a very rich, mucky soil. One half of this field (the higher portion) was ploughed early in the fall, and the other half was plowed in the spring. The field had been used for a meadow. The portion plowed in the spring was utterly destroyed by the cut-worms, while the other portion was not seriously damaged. I had another field lying just across the road. One half of the field had been in corn the pre-

vious season, and had not been kept particularly clean. The other half was old pasture. The corn stubble suffered but little, while the meadow was nearly destroyed. I think I never suffered seriously with the cut-worm but one year before, and that was in 1863.

Now, in regard to the army worm, last season was as wet as was ever known in our county. I don't mean that there was the greatest rain fall in inches, but still we had damp, wet weather, and we had really a very wet season. The previous season was a dry one. We did not suffer severely from the army-worm in my immediate vicinity, although it made its appearance in great numbers in different parts of the country, and in some localities did a great deal of damage. The only point I desire to make in regard to this is that, so far as my observation extends, they did the most damage and were the most numerous away from the marshes. In the southwestern part of the township, which is rather rolling and not marshy, they did a great deal of damage, while in the northeastern portion, where there are many marshes, they did but little damage. I am inclined to think that the theory in regard to a dry season followed by a wet one being favorable for their growth, is probably correct. I have a little recollection of the work of the army-worm in 1855 or 1856. We have but very little occasion to complain of the ravages of the white grub, though in some instances they have been troublesome in old meadows. The remedy is summer fallowing and plenty of pigs.

Prof. Cook.—How about the robins and black birds in your neighborhood?

Mr. Chamberlain.—The law in regard to the birds is not observed, for the people feel that when they go to the trouble of raising fine cherry trees they ought to have a small share of the fruit, and a large number of birds are killed. There are a great many black birds in the swales and marshy portions of the country.

Prof. Cook.—I think the correct idea in regard to a dry and wet season being favorable to the development of the army-worm is this: that the wet season is unfavorable to the development of the parasites which destroy them.

Dean Toof.—Two years ago I had some timothy meadow. A portion of it I plowed in the fall, and on this part they were not troublesome. Aside from that they did some damage.

E. Osborn.—I plowed a piece of sod last spring, commencing about May 10. It was a sandy soil, rather uneven on one side. On two sides it bordered on low ground, and on one side there had been a fence. I planted May 20. After the corn came up they commenced to eat on the higher portions of the field, and they did not touch the corn where the fence had set, and along the edges of the low ground, until they had eaten the rest. When they first commenced to work I hired four or five hands and thought I would dig them out. We worked in the forenoon, but after dinner we found five or six in a hill where we had been over in the morning. I replanted it and it all came up, and they worked badly again. I replanted a portion of it June 23 and 24, and the balance I sewed to Hungarian grass. They worked away until about July 10, when they all disappeared. In the spring, in March, if you remember, there was a rapid thaw which took down the snow-banks and covered the ground with water. The surface of this field was nearly covered, and there came on a sudden freeze. Some boys crossed this field and saw these worms sticking in the ice. They came and told me, and I went and found it to be true. The freezing had no effect on them, and they afterward cut down the corn.

Prof. Cook.—How about the birds in your section?

Mr. Osborn.—A great many of the birds were killed by the cold weather. It was nothing to find every morning near my barn five or six robins, and a small kind of a bird which came early, frozen to death. In one small stub I found seven bluebirds frozen. We have lawless boys who shoot a great many.

DISCUSSION AT ADRIAN.

C. R. Porter, Adrian.—I would like to ask Prof. Cook if he considers salt a preventive for the wire-worm, and if there is any way of preventing angle-worms from working in ground?

Prof. Cook.—I have never had any experience with salt on the wire-worm, but have experimented enough with salt on the cut-worm to know that you can kill your plants before you can injure it. In England the only remedies used to prevent the ravages of the wire-worm are salt and gas lime. Both are considered excellent for this purpose. I should like to have salt tried on the wire-worm. I question whether it would kill them, but gas lime might. I should think that salt, in doses liberal enough to prevent the ravages of the wire-worm would kill corn, potatoes, and other crops. Another thing in England is recommended. They slice potatoes and place them in the ground, with a stick through them as a guide in digging them up. The wire-worms collect around the potatoes in great numbers. This is done before the corn is planted. I think the gas lime would be most effectual in getting rid of these pests.

J. S. Strong, Madison.—I would like to ask how to destroy the plum curculio.

Prof. Cook.—Early in the spring, about the time the plums set, clear the leaves and grass from the roots of the tree, and then place chips or pieces of bark on the bare ground, close to the body of the tree. The plum curculio is a night insect, and most of its ravages are committed after dark. In the day-time, in the early part of the season, you will find them under the chips. The best time to turn over the chips in order to kill the pests is about four o'clock in the afternoon. Later in the season, when it gets warm, they won't go down under the tree. Then place a sheet under the tree, and jar the tree by a sharp blow.

B. Treat, Adrian.—How long do you have to do this work?

Prof. Cook.—Twice a day as long as you get any. By the first of July there are few indeed.

James Helm, Adrian.—I have twenty plum trees which have been bearing for some time. I tried the bark and chip plan and got very few curculios, and but few plums;—by not jarring the trees I lost most of my crop. The spike business is all nonsense. It cannot be done without great injury to the tree. There is another idea from J. J. Thomas, and that is to cut a limb off the tree, and [then strike the stub. The next year you will find the bark decayed and black. It is a mistake to suppose that these pests are nocturnal, for can you find them in the tree, at any time, morn, noon, or night. I have seen them flying in the day time and they are ugly customers. The plan I pursue is to take two long pieces of light wood,—say ten feet in length. Take two strips of yard factory, sew them together, leaving a space in the cloth. Then nail the cloth on the sticks. With this spread out place it under the tree and then jar the tree or limbs so as not to injure the tree. By this means you can save your plums. You must commence early in the season and keep it up as long as you can get any.

Prof. Cook.—There is the best of evidence to prove that the curculio is nocturnal. I have examined the trees in the day-time when none were to be seen,

and then I would go at night and with the aid of a lantern they could be seen busy at work. I will say to the gentleman that the fruit growers in the western part of the State use rubber mallets to strike against the spikes. I know of a number of cases where this plan has been pursued for eight or ten years without injury to the trees.

N. Strong, Madison.—You take a cloudy day and they will work, and that leads me to think they work more nights than in the day time.

Jesse Warren, Adrian.—I raised ten bushels of plums the past year without any jarring or shaking, or any thing of the kind.

Prof. Cook.—I would state that there is no need of jarring these trees unless you find the curculio.

Peter Fowler, Palmyra.—I think a spike would be apt to injure the tree, especially if the tree was a good sized one. It might prove satisfactory on small trees. I should prefer jarring the limbs by means of a rubber or something of that kind on the end of a stick. I think the curculio work a great deal day times, but are most lively nights. In order to raise a crop of plums it is every day business, just like milking.

DISCUSSION AT COLDWATER.

J. S. Dunks, Sherwood.—Are the curculios not more destructive on clay than sandy land?

Prof. Cook.—That is a matter for you to decide. There are many people here who have had a great deal of experience with these pests, and are probably more capable of answering that question. I can, however, see no reason why they should be.

Mr. Reynolds.—I have suffered considerably from the effects of the army-worm. Last season they worked worst on my low land where it was mucky. I had one piece of high ground on which they worked in great numbers, but the ground was very moist, and there was a heavy growth of peas. I want to know whether the moths die soon after laying their eggs.

Prof. Cook.—They usually die very soon after laying their eggs, but have great tenacity of life before that. I have kept the female almost six months before the egg-laying period.

A. G. Rose.—My experience is, that oats which were lying down, were literally covered with them, but the oats which were standing were uninjured.

I. M. Sellover.—I have had some opportunity for observing the work of the army-worm, and it seemed invariably that early sowed oats on rather heavy or sandy soil seemed to be almost entirely free from them. From this I concluded that it operated about such a time in the year, and if the crop was far enough advanced as not to afford the juice which they seemed to seek they passed it by.

A. Gardner, Madison.—There were a great many of these worms on my standing oats. The land was a heavy clay soil. The oats were all dead ripe when I found the worms.

Mr. Benton.—Some years ago in the State of Ohio the army-worm seemed to work altogether on low lands, and on the light loamy lands very few were found.

GRASSES AND FORAGE PLANTS.

BY PROFESSOR W. J. BEAL.

I am expected to speak of the grasses, one of the largest and most widely distributed families of plants. Much may be said in favor of the grasses, taken in the more limited sense as used by botanists. The true grasses *(Gramineæ)* are quite easily distinguished, so that almost any one, with a very little attention, can learn to recognize them with a good degree of certainty. In common language the farmer classifies as grasses all plants used for pasture and meadow. The botanist classifies plants according to a large number of peculiarities of structure, leaving out the separate uses to which they may be placed. One small, artificial group constitutes the cereals, which are raised to a great extent for the size and quality of their grains. These are very valuable for the food of man and his domestic animals. The chief cereal grasses are wheat, Indian corn, rye, barley, oats, and rice. They constitute a large part of the food of the human race the world over. A much larger number are valuable for meadows and pastures. The grasses are annuals or perennials, mostly herbs, with fibrous roots,—sometimes a creeping stem or rhizome. There is in no case a tap root to a grass. The stem is round, or nearly so, generally hollow, as in wheat, sometimes solid, as in broom corn. The nodes or joints are all solid, and usually swollen. The leaves are alternate, two-ranked, one starting from each node, so that as we hold a stem before us there will be here a leaf to the left, a little above is the second leaf to the right, a little farther up the third leaf to the left, directly over the first, and so on to the top of every straight stem. The lower part of the leaf makes a sheath around the stem. This sheath is split down, or open on one side, opposite the center of the back of the base of the leaf. The blade or expanded portion is usually long and narrow, with no notches along the margins. They may be stripped or torn into long fibres. They are parallel-veined. Where the blade leaves the stem and sheath there is often a membranous appendage called the ligule.

I will not here enter into the more technical description of the flowers by which the different grasses are mostly distinguished. The family is a remarkably natural one, and, contrary to a general rule, it can be quite easily described by its stems and leaves alone, with sufficient accuracy to distinguish it from any other family. To repeat, *the leaves are entire at the edge, parallel-veined, two-ranked, and the sheath split down on the side opposite the blade.*

Grasses all bear flowers, some of which are here shown upon the chart. This is a head or spike of timothy. Here are the separate flowers. This is a spikelet, that a panicle, of a Poa.

Sedges are very common on our marshes, and constitute a large part of what is often known as marsh hay. They are also, to some extent, found on high land of poor quality. All sedges make very poor fodder, when compared with the better grasses. Sedges have three-ranked leaves, or leaves spreading in three directions instead of in two directions, as in the grasses. The sheath may be quite short, but in all cases it is closed, making a tight tube around the stem. These characters are enough to distinguish our sedges from the grasses. The clovers and the like bear flowers which are more or less conspicuous. The leaves are compound, having three or more leaflets to each main leaf stalk. The

clovers, in botany, are leguminous plants, and belong with peas, beans, vetches, lucern, sainfoin, lupines, locusts, etc.

PASTURES OF THE BRITISH ISLANDS.

Among all the nations of the earth, none, that I am aware of, has given so much and so careful attention to pastures and meadows as our friends of the British Isles. Rent is there very high. To be a successful farmer everything must be done to the best advantage. Slip-shod farming there will not afford a living, as it often does in our newer country. Although they follow out a certain rotation of crops, and are able to give good reasons for such rotations, yet they are nearly, if not quite, unanimous in keeping a part of the farm in permanent pasture or meadow. The longer a piece has been seeded the better it suits them. According to their belief and practice, a pasture never becomes very good until it has been seeded six or more years. In their opinion, "it is certainly undesirable to break up tolerably good pastures for the purpose of converting them into arable land."

So carefully have they studied the nature of the different grasses and the soils they are adapted to that the seedsmen, according to demand, sell certain mixtures of grass seeds suitable for each geological formation.

In laying down land to permanent pasture, M. H. Sutton, of Reading, England, in 1861, gives the following list of grasses, and clovers, and the quantity of each which he considers "the best possible mixture for a good medium soil, neither too heavy nor too light. These are all," he says, "of excellent properties; and, coming to maturity at different seasons of the year, are found to produce a permanent and evergreen sward:"

	Lbs.
Alopecurus pratensis (meadow fox-tail)	1
Anthoxanthum odoratum (sweet vernal grass)	½
Cynosurus cristatus (crested dog's-tail)	1
Dactylis glomerata (orchard grass)	2
Festuca duriuscula (hard fescue)	4
Festuca pratensis (meadow fescue)	4
Festuca ovina (sheep's festue)	2
Festuca rubra (red fescue)	2
Festuca tenuifolia (slender fescue)	2
Festuca loliacea (darnel-like fescue)	2
Lolium perenne sempervirens (evergreen perennial darnel)	6
Lolium perenne tenue (slender perennial darnel)	4
Phleum pratense (timothy)	1
Poa pratensis (Kentucky blue-grass, June grass)	1
Poa trivialis (rough-stalked meadow)	1
Poa nemoralis (wood meadow-grass)	1
Medicago lupulina (none such, medisk)	1
Trifolium repens (white clover)	4
Trifolium repens perenne (perennial white clover)	4
Trifolium pratense perenne (perennial red clover)	1
Trifolium hybridum (Alsike clover)	2

For a varied soil in Cumberland, England, in 1875, Robert Jefferson uses 40 lbs. per acre of the following:

	Lbs.		Lbs.
Italian rye-grass	6	Rough-stalked meadow grass	2
Perennial rye-grass	6	Meadow foxtail	2
Cocksfoot (orchard grass)	3	Crested dogstail	1
Timothy "	2	Rib grass	1
Meadow fescue	3	Alsike clover	5
Various-leaved fescue	1	White "	5
Cow grass	3		

John Shuker, of Shropshire, on most tenacious soil, used 40 lbs. per acre of the following:

	Lbs.		Lbs.
Crested dogstail	4	Meadow foxtail	2
Sweet vernal	1	Timothy	4
Cocksfoot	3	Alsike clover	2
Tall fescue	4	White "	2
Meadow fescue	4	Perennial rye-grass	6
Rough-stalked meadow grass	3	Italian "	5

For shaly soils he used 32 lbs. per acre of the following:

	Lbs.		Lbs.
Sweet vernal	2	Tall fescue	2
Crested dogstail	3	White clover	4
Meadow fescue	2	Alsike "	2
Cocksfoot	3	Rib-grass	2
Sheep's fescue	2	Perennial rye-grass	8
Rough-stalked meadow grass	2		

R. H. Huntley, of Coldstream, England, in the report of this year (1875) says he "laid down three fields to permanent grass by the process known as 'inoculation.'" All succeeded finely. With a plow he turned from an old pasture field strips of turf four inches wide. These were cut up with spades into pieces four inches long. They were put all over the new field in little holes one foot apart. Then the field was rolled. I have quite often seeded small pieces of lawn in this way. It is a surer and more rapid way than by using seed for lawns.

PERMANENT PASTURES.

It is the general belief in Great Britain, so far as I can learn, that permanent pasture when properly managed yields a better quality of grass or hay than one newly seeded, and that the quantity does not diminish with the age of the pasture. They often seed a new piece without any crop, like oats or wheat. Sometimes the mixture of light seeds is sown, and then the mixture of heavy seeds sown by itself on the same ground to spread all evenly. If the ground is well prepared, a newly seeded field will need no manure for two or three years. Most British pastures will grow poor and thin and run out, as we say, unless they are manured and otherwise properly attended to. If we continually take off and plunder a field what other result can be expected? Manure often goes upon the arable land with us.

J. Dixon of Cheshire, England, in a prize essay for 1858, says: "After 20 years of experience I have no hesitation in pronouncing bones to be preëminent above all other manures for the improvement of grass lands, when permanency as well as cost are considered." He is decidedly in favor of raw bones, ground and applied in early spring. He cites one case treated with broken bones 70 years previous, where the effect was still very marked. In one case, about 1,000 lbs. of bones to the acre in two years caused the yearly rent of an acre to go from 30 shillings up to 60 shillings, with a greater profit to the tenant. He gives other cases,—among them a farm of 160 acres on which the farmer expended £300 sterling worth of bones in a year. The stock formerly kept consisted of 20 cows, and 3 or 4 horses and colts. After treating with bones the fields pastured 43 cows, 16 head of young stock, 5 horses and 3 colts, and one-forth of the farm in tillage. Similar results were produced on almost every farm in the neighborhood.

Professor Voelcker (Royal Journal of Agriculture, 1868, p. 643) says: "The effects produced by the application of bone-dust to pastures are very variable.

On the porous land of Cheshire and similar soils on the red-sandstone formation, the result is very striking. On land which is wet and cold and rests on a poor, undrained subsoil, bones ofter produce no effect. He recommends in all cases, a trial on a small scale.

EXPERIMENTS.

Experiments to be of much value must be kept up for a long time. As Prof. Voelcker says, "Field experiments, in order to be practically useful, should always be tried for a succession of years under as great a variety of conditions as regards soil, time, and mode of application, and crops, as possible." This should be continued from year to year according to the same plan as fixed upon in the previous years. Some of the best experiments made, at great expense, in England, were tried for 20 successive years before arriving at satisfactory conclusions.

Old pastures in England often get a dressing of 150 lbs. of nitrate of soda, or 300 lbs. of guano, or 200 lbs. of superphosphate, sown broadcast on each acre. Such dressings with barnyard manure are often applied until the land produces well.

In a prize essay by Clement Cadle he claims much experience in the manuring of grass lands,—a most difficult subject. He has seen bones do no good whatever, and he has seen them used with immense advantage. He has seen guano used and produce a splendid crop the same year, and next year the crop was worse than before the guano was applied. It seems impossible to tell with certainty just which fertilizers will do the best on any soil till they have been tried. Mr. Cadle's rule is this: "In proportion as the land is inclined to grow benty or stocky grass, inclining to seed, he applies ammoniacal manures. If the land produces thick, short, leafy herbage, the phosphatic manures must be applied." After twenty years he concludes that in England money judiciously used in improving grass land pays a more certain return than where expended in the growth of wheat.

S. H. Thomson, a prominent farmer of York, also concludes that money used in improving grass land gives a better return than on arable land. He says that "firmness and quality cannot be secured with large bulk. For quantity of hay or pasture use guano, nitrate of soda, soot, or other ammoniacal manure; for quality use lime or bones; for medium quantity, and quality, use both classes of fertilizers." Coarsely pulverized bones and barnyard manure produce lasting results, often very marked for twenty years. Good barnyard manure is the standard, and never fails to improve grass lands. In the report for 1875, Mr. Lawes, the most celebrated English experimenter, says: "The application of bones to grass land is not recommended for general adoption. They appear to be chiefly adapted to the exhausted pastures of certain localities. The same is true with lime. Every man must experiment." He adds: "I am disposed to think that a dressing of dung once in five years, and 200 lbs. of nitrate of soda the other four years, is about as good an application as can be used." I should recommend a mixture of fertilizers found to be good, or a rotation of their use.

The English well know the great importance of excellent pasture to fatten cattle. They feed such cattle while grazing, oil-cake, meal, etc., for a two-fold object, namely: to help fatten the cattle, and to help enrich the soil, and so make the pasture better. This is sound doctrine, which we all understand. There are certain well-known truths in regard to manures that are almost axi-

oms; as, "The more abundant the food supplied to beasts, the better the quality and the larger the quantity of manure which is produced;" "Beasts fed on good, nutritious food, give a much more valuable manure than when fed upon indifferent kinds of food;" "The manure of young animals is less valuable than that from mature animals, as the young require both organic and inorganic food in larger quantities than full-grown beasts which have only to keep up their weight and condition by the food they eat;" and that the best animal manures for general purposes consist of both solid and liquid excrements combined.

EFFECT OF SPECIAL MANURES.

One objection often made to keeping land permanently in grass is that weeds come in and crowd out the grasses. This is only true in neglected fields, as is shown by the following:

In a report of Lawes and Gilbert, the most celebrated English experimenters, they arrive at this general result: "*That those manures which much increased the produce of hay, at the same time very much increased its proportion of graminaceous herbage,*" often changing the relative quantity from 76 per cent to 97 per cent. By the above they mean that the true grasses crowd out the weeds when the land is highly manured. There are a few weeds that are not diminished by manuring, but the most of them are diminished. Lawes and Gilbert made some very interesting experiments with different manures on permanent meadow land.

IRRIGATION.

In addition to the above, I wish to briefly refer to another remarkable point. At great labor and expense they tried similar pieces of meadows with different fertilizers. The change in relative proportion of plants in the meadow was very striking.

By irrigation, in England, it has been found that some grasses increase, others decrease; that "large and innutritious herbs in pastures are destroyed by irrigation, their place being supplied by the best grasses." Docks and a few others are an exception to this rule.

WHEN TO CUT GRASS.

One great cause of deterioration of meadow land the English have fully learned: that is, "by allowing grass to get too old before cutting." This not only makes the hay of poorer quality, but it weakens the plants. This fact cannot be too strongly impressed upon farmers everywhere. This principle is well understood and practiced by the gardener. He knows that his plants will grow larger and last longer if he pinches the flower-buds off, or if he prevents them from going to seed. We can prolong the life of nearly every herb by preventing it from seeding. Wheat may be made to last another year beyond its usual time if the flower stalks are kept cut back. Nothing is more trying to clover than to permit it to go to seed. The earlier hay is cut, the better for the strength and longevity of the plants. Among our farmers there is still a difference of opinion as to the best time to cut grass for hay. Most of them believe it is best to mow when the plants are in blossom, but many of them wait longer. I have just given a well-established rule, that for the good of the plant, cut before the flowers appear. In the American Agriculturist for 1875, page 213, Prof. W. O. Atwater gives the latest conclusions of the chemist on the proper

time to cut hay: "It depends, 1st, upon the feeding value of the crop gathered; 2d, upon the value of the aftergrowth; 3d, upon the value of the roots and stubble left to enrich the soil for another crop." He says: "We are forced to the conclusion that, as far as the *feeding value* of the crop is concerned, the most profitable time for harvesting clover is a little before the period of full blossom. The experiments upon other grasses have not been as extensive, but so far as they have been made, as well as from analogy, we may adopt the same conclusions." And he adds: "These results, obtained by positive science, agree with the experience of the most observing, intelligent, practical men." Another thing: if we cut early, we save more time for the second growth, for another mowing or feeding. The whole of the article referred to is worthy of careful study.

I am not a chemist, nor have I made careful experiments to find the best time to cut hay; but in an address, January, 1872, printed in the Report of the Michigan Board of Agriculture, on theoretical grounds, with some observation, I stated that grasses should be cut earlier than is the practice with most farmers, —*a little before the plants were in flower*. Several reasons are there given, some of which are the same as now given by Prof. Atwater.

DRAINAGE.

Again and again the best English farmers have proven that it pays to drain wet lands for the grasses. We have often seen the same thing done in different parts of this State, always with good results. Such fields stand the drought better and yield more and better feed. The sedges die out. There is always an improvement, notwithstanding the fears and cautions expressed before ditching. I cannot hear of a pasture anywhere which has been injured by tiling. I never expect to.

MOWING PASTURES.

Two other customs may now be added in the treatment of English pastures. The droppings of cattle are often broken up and scattered to prevent rank spots, which are not eaten off by stock. It takes less time than might be supposed. They also mow off small patches of grass at a time, where it is found running to seed. A small quantity at a time is readily eaten on the ground by the stock, as it wilts and partially cures. Thistles and many other weeds are treated in the same manner. In place of the weeds and seeding grasses will often spring up a fresh bite, very agreeable to stock of all kinds. In pastures in this country we very often see June grass and other grasses seeding early in the season, thus weakening the roots. The dead dry tops are left all summer, where, if cut off in time or eaten off, there would be a good supply of fresh herbage all the season.

After getting a large number of replies from some of the best farmers of England last year (1875), in a summary given by Morgan Evans, he says:

"It appears to be the general practice of those who have laid down permanent pasture, to select for the purpose the loamy, retentive portions of the farm, and to cultivate the lighter, more easily worked, as arable land. At the latest date the most popular grasses are timothy, alsike, several fescues, white clover, rye grass, and a few others. More seeds are sown to the acre than was formerly thought necessary; a brushing or light harrowing follows the sowing. Some mow and some pasture the young grass the first season, being careful not to cut or feed too close. The use of artificial feeds for grazing stock is very highly

spoken of as a most effectual way to improve pastures. There is no difference of opinion as to the great value of a top-dressing of farmyard manure on grass land."

The most valuable manuring substances are the following: first, nitrogen; second, phosphates; third, alkalies, especially potash.

Mr. Lawes, the high authority previously referred to, says: "You may be sure that the production of pasture is a most costly operation, and it takes a lifetime to convert arable land into a pasture."

Alternate grazing and pasturing are highly recommended. Seeding by "inoculation" is rarely practiced, on account of the great expense.

I have thus purposely devoted considerable time to grass-lands as treated in Great Britain, although we may not be able to adopt their practices in every particular. In England labor is much cheaper, land is more valuable. This makes hay, pasture, meat, and grain higher. They can afford to pay more for artificial fertilizers. Their climate is cooler and damper in summer. On this account grasses grow thriftier and are not so likely to burn out in warmest weather. Their autumn, winter and spring are milder and more favorable to the better sorts of grasses. They have long tried and used many sorts.

PASTURES OF MICHIGAN.

In the newer portions of our country timothy and clover are about all that are sown. In the best grazing sections of the older parts of the United States quite a large number of grasses are employed. It is too often the case with the farmers of Michigan that the land is run down by field crops without much manure. The soil is in bad condition, timothy and clover are sown, they do not catch well unless the season is very favorable, time and money are lost, the land is plowed up again for more crops. At best clover cannot be relied on to last but two years without reseeding. Unless June grass comes in, the remaining timothy will not make a good pasture.

MANAGING PASTURES AND MEADOWS.

Pastures are usually fed closely, especially in dry time. Stock are allowed to run in them in the fall as long as there is a green thing in sight. The foliage is all taken off clear down, including part of the roots, which are left weak and exposed all winter and spring. During winter stock ramble over fields, killing the grass under their feet. Before the frost is out of the ground cattle are digging away at the old turf again and treading it up full of holes. In this way the poor grass is beaten and eaten, and half starved, until, after a time, depending upon the strength of the soil, the grass is said to "run out," and the field "to need breaking up." This is not the way to treat grass land.

Meadows are often pastured for a fresh bite in spring, the stock are turned off till one crop is mowed, and then back again where they eat all off closely, as in the case of the pasture just noticed. Plants, to remain strong and healthy, need at least a little time to get nourishment ahead for winter protection. Like animals, they ought to be strong when winter sets in.

So far as I have observed, almost nothing has been done in our country in the way of fertilizing and improving permanent pasture. We hardly know the value of an excellent pasture of fine grasses all summer, because very few have such to feed.

MORE MANURE.

It may be objected that it is all well enough to talk about the use of more manure,—to manure the grass land; but will it pay in this country? Emphatically, yes! I refer you to some experiments made by Dr. R. C. Kedzie in top-dressing meadow, printed in our report for 1864. The outlay pays from 35 to over 100 per cent. per annum. The top-dressing used consisted in ashes, muck, plaster, salt, cow and horse manure. We have found at the Agricultural College that we can make a valuable compost of muck and barnyard manure for 25 to 50 cents a cubic yard. On most farms the supply and value of manure can be trebled as well as not by the use of muck. Bones can be pounded up during winter with a sledge-hammer, and mixed with ashes or fermenting manure, or sown directly on the land. Many a dead sheep, horse, or ox is buried which should be cut up in pieces and mixed with the manure. On one of the poor barren islands near the eastern coast of Maine, I saw the heaviest growth of timothy I ever heard of. It was six feet high, and had been liberally treated with fish guano. If a farmer can really once believe that it is profitable to pay good attention to his grass land, he will find ways enough to increase the quantity of his fertilizers.

Whether it is best for a farmer to keep some of his land permanently to grass, or to keep all of it under the plow occasionally, I cannot tell; but I believe Michigan ought to have more permanent pasture. If we allow the grass to remain only two or three years at a time, there is no use of sowing the finer sorts, as Kentucky blue grass, red-top, fox-tail, or the fescues. As to the relative value of grasses there must always be a variety of views, on account of climate, soil, what they are used for, how they are treated, etc. Whether it pays to drain land well or not, I am almost ashamed to mention to such a body of intelligent farmers as are here assembled. You know it pays. Yet we must keep repeating this as long as there is so much wet land about us which does not produce half a crop. It is not yet many years since the people of Geneva, New York, made all sorts of fun of John Johnson for burying crockery in his fields,—referring to his ditching with tiles. He has lived to see a complete revolution in all the country about him.

NATIVE AND FOREIGN GRASSES.

Some people think we should use only the grasses native to our country. But by a moment's thought on this we see that such grasses are not necessarily the best because they are natives. Foreign plants and foreign insects often thrive better than our cultivated ones. I need only refer to the thriftiness of the imported codling moth, weevil, and Hessian fly, and to most of the worst weeds in our gardens and fields. Almost any farm in the State containing a variety of soil will be found to grow already as many as fifty or more species of grass. On the farm of the Agricultural College, saying nothing about the experimental plats, I have found about 75 species, besides the cereals and clovers. There are probably growing wild in the State, at present, about 115 species. These grasses make their own selection of place, and from this circumstance we can learn a useful lesson: "Some prefer low, wet situations, others grow only on dry ground; some prefer the shade of forest trees, while others flourish best on the most exposed parts of the broad prairies; some grow only in the water, others along the margins of lakes and streams; some attain their maturity early

in the season, others late in autumn."—*I. A. Lapham.* Some of the grasses are our vilest weeds, as chess in our fields of wheat, barnyard grass, and finger grass, and several known as pigeon grass, and hair grass, and others.

WHICH ARE THE BEST?

I wish I were able to tell you just which grasses are the best to raise in every case, but this will probably never be done,—at least not for many years yet. Nothing can be done which will release every farmer from experimenting on his own ground. No chemist can or ever will be able to analyze a handful of his soil and tell him just what is the best thing to put on it. We are experimenting with a large number of species, 150 or more, on a small scale, and are just about to try some of the more prominent ones on a larger scale. I am often asked the merits of this or that grass.

MORE EXPERIMENTS NEEDED.

I advise thinking men to try a large number of sorts and watch the results; but try them on a small scale at first. Do not mistake me in advising to try all the new grasses to be had. Many do not half use what they have already. I would be far from advising any man to pay large prices for fancy stocks, and then make them mean scrubs by taking no care of them. I have seen too much money fooled away in such speculations. Better farming is one of our greatest needs. Seeds of new grasses are high and hard to get, and with no experience it would not pay to invest largely; but I am sure it is safe to start on a small scale, and raise your own seeds and watch the result. Give all of them a good fair chance before condemning them as worthless. Some seedsmen try to be very accommodating and sell several kinds, each from the same barrel, as pure and unadulterated. Experiments are needed to try to improve our best species of grass. This has been done in Egland to some extent upon rye grass, orchard grass, and others, until in some cases varieties have been originated as unlike each other as are our varieties of wheat among each other. They differ as much as pop-corn differs from sweet corn or dent corn, or as much as these differ among each other. Home-grown grass seeds are better for us than those grown in England. They are more likely to grow. They have become acclimated.

SOME PROMINENT GRASSES.

I will now offer some remarks upon a few of the grasses which have attracted most attention.

Alopecurus pratensis (meadow foxtail) is two to three or even four feet high, having soft spikes of flowers, larger, shorter and more uneven than spikes of timothy. Leaves rather broad, smooth and flat. It has an excellent reputation in most parts of Great Britain, where it is chief among old pastures. It requires three or four years to get well established, hence not good for alternate husbandry. It is quite common in Maine and some other parts of New England. The stalks are too short to be just the thing for meadow. It starts very early in spring and flowers about four weeks earlier than timothy. It loves moist land, clay loam, or drained swamps. It is said not to like sand, though it made a good growth on dry sand among my grass plats for three summers at the College, where it was sown late and the season dry. It is good for lawns, as it starts early, keeps even and bears mowing often.

Several years ago there was some sown on new land with orchard grass, June grass and white clover. It never was found on the ground to any extent. Quite

likely the seed was poor. The seeds are very subject to blight and are apt to be eaten in the head by small insects. Good seeds are high and hard to get. They weigh only five pounds to the bushel.

Alopecurus agrestis (slender foxtail, mousetail, black bent) is well known in the old country. I should not mention this here, but some effort is being made to sell it in the west. In Europe they make such remarks as this about it: "Of no importance as an agricultural grass;" "Cattle do not like it;" "Refuse to eat it;" "*One of the most troublesome of weeds.*" We should be cautious in trying slender foxtail, not because it is a weed, but for all the reasons given above. Some people call June grass only a weed, still it is the basis of the best old pastures in the Northern States.

Phleum pratense (timothy, herd's grass, cat's tail grass).* This is the best known and most extensively sown of any grass in the United States. It is generally sown with clover, though not ripening till some time after clover. It is too well known to need much description. It is not so highly prized in Great Britain as in this country. One writer there describes it as "a hard, coarse grass, of little value for cattle." Its second growth, as all farmers know, is very long starting, often of no importance. Its first crop in strong land is some times very large; three or more tons to the acre. It is heavy for its bulk, as a large part of its weight consists of the stalks and heads. It must not be cut close, for fear of cutting off the bulbs near the ground, or cutting so near the bulbs that they die, roots and all. On account of the important part these bulbs serve, the grass is unsuitable for pasture, especially for sheep, which nip very close. No doubt this close feeding is one of the main causes of its generally running out after two or three years. If kept only for meadow, never pastured, I presume it would last for many years on good soil. I need hardly tell you that timothy, as well as most other grasses, makes poor hay after it has been allowed to go to seed. It produces an abundance of good seed, which may be one reason for its popularity. Instead of sowing timothy with red clover, it would seem to me more sensible to sow orchard grass with clover, or to sow some other kinds that flower at the same time. It is not adapted to sand or dry gravel. Chemists give it high praise for its nutritious qualities.

Agrostis vulgaris (red-top), is known also as Burden's grass in New England and Herd's grass in Pennsylvania. In some places it is called red bent grass or summer dew grass; sometimes foul meadow grass, though the latter name more especially belongs to *Poa serotina.* It is tolerably well known, and quite common in this country, where it is almost always found in moist places. It flowers rather late, with or after timothy. It makes good pasture and good hay, though rather light for its bulk. It is not very rich in starch, gum, sugar, or silex. It is not well adapted to sow for one crop, followed by plowing, as it takes some years to get well established. It varies a good deal in appearance. It is prized by the New York dairymen, though not much esteemed in England. Though commonly known in this country as good for wet pastures, in England it is recommended as very suitable to stand severe dry weather in dry ground. I have noticed that it does about as well as anything at the Agricultural College in dry, barren, sandy places.

Calamagrostis Canadensis (blue-joint, reed grass). This is quite large, a native grass, thriving in low places, giving a big yield of rather coarse hay of good quality, if cut before it is out of the flower. It also makes good pasture

* In several of the accounts of these grasses I give nearly the words as found in late numbers of the Prairie Farmer. Such accounts were prepared by me.

on bottom land, where it grows with red top and fowl meadow grass. We lack definite information about the value of this grass, as is the case with most of our grasses.

Dactylis glomerata (orchard grass, or rough cock's-foot), is found all over Europe, and in the adjoining parts of Asia and Africa. It has been introduced into some parts of the United States. It has been grown over a hundred years in England, where it has met with great favor, both for pasture and meadow. To make good pasture it needs cropping often. It is particularly necessary to cut this grass for hay as soon as in flower: as soon as red clover, or sooner. On account of its earliness it is often too ripe before it is cut; then the grass is condemned because it does not make good hay. Where it does well it is just the thing to sow with red clover. I quote from a former lecture printed in our last agricultural report: "It starts very soon after being mowed. It is very nutritious. Stock like it. It should be sown thickly and cut early. It thrives very well in shady places. Its growth in tufts is one objection to it for meadow or lawn. A Mr. Hyde of Massachusetts says, in a recent lecture that he has mowed one piece for eight years, twice a year, and that it is as good as ever. In Kentucky some sow nothing else with clover. When grazed down and stock are turned off, it will be ready for regrazing in less than one-half the time required for June grass. In summer, he says it will grow more in a day than blue grass will in a week. It has been neglected because it is the fashion to sow timothy and clover. Fashion is as much of a tyrant among farmer as among the ladies, though showing his power in a different mode."

An eminent farmer of Scotland says: "Cocksfoot is probably the best known and most productive and valuable of our indigenous grasses." My advice is to give it a trial if you have not already done so; but, according to one author, do not sow it for lawns, because it grows so fast you would be obliged to cut it every morning before breakfast. A Pennsylvania farmer used to say his sheep might go supperless to bed, but in the morning their breakfast would be already grown for them. This grass is rapidly growing in favor in many parts of the Northern States. Flint says, "It is worthy of a much more extended cultivation among us." The late J. S. Gould, in New York Agricultural Report, says: "The testimony that has been collected from all parts of the world for two centuries past establishes the place of this species among the very best of our forage grasses, and we have not the shadow of a doubt that the interests of our graziers and dairymen would be greatly promoted by its more extended cultivation."

Poa serotina (fowl meadow grass, false red-top, late poa, swamp wire grass). This is a tall, slender grass, growing along our river bottoms with red-top. It is of most excellent quality for hay and pasture, though its aftermath is of slow growth when compared with some others. Unlike most grasses, its stem remains green and retains its nutritive properties for a long time after going to seed. On this account you can cut it whenever you get ready. It does not stand up well unless sown with blue joint or some others with stout stems.

Poa pratensis has a multitude of common names such as Kentucky blue grass, June grass, smooth stalked meadow grass, green meadow grass, spear grass. No grass in this country plays so important a part in our best pastures. It varies much in size and texture, and in color from green to purple and red. It abounds in the famous pastures of Kentucky, where it generally grows rather larger than in our cooler climate. It always abounds in the regions where the best butter and cheese is made. "It is not so often sown as some others, but works its way into pastures with wonderful rapidity, and then holds its own,

too, with great tenacity. It has a creeping root stalk, which helps it spread and retain its footing. It is very early, flowering early in June, but seldom, if ever, flowering a second time in the year. It requires two or three years to get well established, hence it is not well adapted to alternate husbandry. It is remarkable for the second growth, or for a continued growth after it has been mown or eaten off by stock. It is one of the most widely diffused of any grasses in the world. Notwithstanding some call it a useless weed, it is chief among our lawn grasses,—worth more than all the rest put together, in most places. It is too often estimated by its rather short stalks, as seen in dry meadows, than by its quick second growth of nutritious grass."

Poa compressa (wire grass, blue grass). This is often found in rather dry thin pastures. It never makes a compact turf. It has a very dark blue stem, considerably flattened or compressed, by which it may be easily distinguished. The top or panicle is small. Like fowl meadow grass, it may be allowed to get ripe before cutting, as its stalk remains green and nutritious. It shrinks very little in curing so the yield of hay will be two or three times the amount by weight or value, that one would guess who is accustomed to handle other grasses. The hay or grass is of unsurpassed quality for butter and cheese. Gould says by repeated trial he has found that horses will do better on this hay alone than they will on timothy and oats. [He doesn't mention the proportion of timothy to oats.] It is very hardy and often despised on account of its size as a weed. Every dry pasture on heavy land will be the better for containing some of this grass. It gums the knives of the mower badly.

Festuca elatior (meadow fesque). This also includes several varieties prominent among them is the variety *pratensis*. To an inexperienced eye it looks like large coarse June grass. It flowers soon after June grass. It thrives especially on stiff soil, and does tolerably well in partial shade. Its value is well established as nutritious, productive, and a favorite with cattle and men in dairy countries. I should unquestionably recommend it as of first rank for pasture or meadow, especially the latter, but unlike wire grass and fowl meadow grass it must not be past the flower to make good hay.

Lolium perenne (perennial rye grass, ray grass, darnel). This also includes a large number of varieties, a prominent one of which is Italian rye grass. The latter (Italian rye grass) is remarkably vigorous and well suited for soiling or alternate husbandry as it will only remain two years without reseeding. Most of the varieties of rye grass are highly recommended where they have been tried, as "good for butter and cheese." It grows very rapidly and matures seed the first year. I copy now something I wrote a few days ago for the Prairie Farmer, on this grass. "The fame of this grass is of long standing in Great Britain, having been cultivated as early as 1677—almost two hundred years ago. It was the first grass artificially sown or cultivated in that country. It is in England what timothy is in our new countries, the best known and most generally raised; so that a good English writer says of it: 'No species of grass has ever attracted so much interest among our agriculturists as this.' The seed is easily raised, often forty bushels to the acre the first year it is sown. Like most grasses it thrives best on good, strong soil, and like a large crop of any plant, it will exhaust the soil to some extent. It flowers early and late. The leaves are rather broad, flat, bright green, and shining. The stalk is rather short, straight, and stiff, not very pretty. The spike or head looks some like a very slender spike of quack grass. These seeds are sometimes mixed, so that before an incautious farmer knows it, his farm is well strewn

with that arch fiend among weeds, *quack grass*. All kinds of stock are fond of rye grass, and agree with the chemist in deciding it to be very nutritious and wholesome. It is nice for lawns and parture, but rather short for hay though of excellent quality. The Italian variety is better, but does not last for over two years, while the shorter smaller varieties last longer."

It starts so soon after mowing, that it may be cut two or three times or more in a season. It likes a rather moist climate and rich soil, which is true of most of our best grasses. It has stood well in rich lawn for at least eight years at the college, does not winter-kill. We ought to select and get good varieties of this variable grass.

Triticum repens (couch grass, witch grass, quitch grass, twich grass, chadler grass, quack grass). This would be a good grass to raise for meadow or pasture if you never cared to get rid of it. On the western plains in some places it affords much feed in dry soil. It creeps precisely like June grass, but has larger roots and underground stems and is much harder to kill out. It is a vile pest.

OTHER FORAGE PLANTS.

Unquestionably red clover holds the first rank among forage plants other than the grasses proper. Its peculiarities are too well known to you for me to add much at this time. The short life of clover is one thing against it. Too many farmers forget or do not seem to know that red clover is naturally a biennial, *i. e.*, only intended to live two years. Some of it often lasts several years longer, but the main crop dies at the end of the second season, unless it has been well treated with reference to prolonging its life. In England they claim to have a variety (not species) of red clover which will last for several years. By a continued selection of seeds for several years, I have no doubt that we could get such a variety for our country.

Of alsike clover, I have seen but little. It falls down too much to be a favorite for mowing. For pasture I have heard much in its favor.

We have tried lucern a little. It looks some like clover, though more slender and stands up better.

It starts very soon after mowing. It lasts for many years. The roots are very long and large and tough, containing many woody fibers. It stands dry weather without wilting better than red clover or any forage plant with which I am acquainted. In England it is said to be much superior to clover for soiling milch cows, giving no taste to milk or butter.

It have now mentioned a few of the best grasses and forage plants omitting almost entirely descriptions by which they can be distinguished from each other. You see they look so nearly alike that it requires much care and observation to learn them. You, no doubt, also agree with me in saying that this grass question is one of vast importance; it holds the first rank in our agriculture.

VALUE OF HAY AND PASTURE.

According to the census, the hay crop of Michigan for 1873 was 1,134,484 tons. It is fair to call the pasture worth as much more. Calling the hay worth $10 a ton, it amounts to $11,344,840, or the hay and pasture for the whole State $22,689,680. This exceeds the value of the wheat crop by several millions of dollars a year. The average per acre is not given but it is not far from one and one-half tons. Perhaps it is as well to omit it for some reasons

Good farmers would be ashamed of the small average of the hay per acre. Grass is king among the crops of the United States.

PRIZES TO BE OFFERED.

If our agricultural societies would offer special prizes for the best pastures and meadows, it might awaken more interest in this subject. A special committee should visit the places in the proper season, and might make a valuable report each year in a manner some like the orchard committee of the State Horticultural Society.

WHAT STOCK SHALL WE KEEP? LECTURE DELIVERED AT FARMER'S INSTITUTES IN ARMADA, ROCHESTER, ADRIAN, COLDWATER, AND YPSILANTI, IN JANUARY AND FEBRUARY, 1876.

BY C. L. INGERSOLL.

Mr. President, Ladies and Gentlemen,—It seems to me that this question is one of vital importance,—vastly more so than many of you perhaps think. It perhaps may not have entered your minds that the stock interest of the United States is larger than any other single item with which farmers have to deal.

Not only this but larger than many others combined. In Appleton's Encyclopædia we find an estimate for 1873 of the stock interest for that year, compared with the ten principal crops raised; including wheat, corn, rye, barley, oats, buckwheat, flax, etc., and then we find the stock interest exceeding the united sums of these by over $20,000,000. The figures are these: stock owned $1,684,431,692 worth; ten principal crops raised in 1873, valued at $1,661,505,043. This serves to give you some idea of the stock interest in our country, and indeed it is not surprising when we think that every farmer has some stock; but no single farmer raises more than five or six out of the ten principal crops, and a large majority not more than three or four of them.

This question is also intimately connected with the manure question,—a question which too many Michigan farmers have not looked squarely in the face, and one that they must soon pay more attention to. The deleterious system of cropping their farms practiced by a large majority of our farmers, and then selling all or nearly all of the products without returning manures to their farms, cannot but tell in time on their prosperity and the value of their farms. They are perhaps making money, but their farms are more than that amount of money impoverished.

The fact that the yield of wheat, corn, oats and other grain crops is gradually falling lower and lower calls loudly on Michigan farmers to investigate this evil and remedy it. Not that we are worse than our sister States, but we should all wake up and see if something cannot be done. In the twelve States where most wheat is raised, the average in the last ten or fifteen years has fallen from three to five bushels per acre, and this in the face of the fact that much new land is opened up each year and sown to wheat on which large crops are raised.

Of these States I will mention Indiana, Illinois, Michigan, Iowa, and California, which are eminently wheat-growing States. To show you the necessity

of manure of some kind in order to keep up the fertility of our land I will call your attention to some experiments performed by Prof. Lawes in England, extending over a series of 22 years. I will not take your time except to give you the average for the 22 years, wheat being raised and each plat being treated precisely in the same manner each year. The 1st plat was unmanured and raised 14½ bushels per acre average for the 22 years. The 2d well manured with farm yard manure, average 35¼ bushels. The 3d treated to 200 lbs. ammonial manure per acre in the fall, each year, average 34⅝ bushels. The 4th the same applied in spring average 37¾ bushels. The 5th treated to same amount of nitrate of soda, average 37 bushels. You have here an average illustration of the value of manures to land if cropped continually, and also the fact forcibly illustrated that well rotted farm-yard manure in liberal doses is about as good as the commercial antidotes for poor land. Each farmer has the means at his command by increasing his stock aund feeding all the coarse products of the farm at least, and returning the manures to keep up the fertility of his farm. Then the question comes up, "What stock shall we keep?" I will answer by saying, "keep pure-bred stock of some breed adapted to the wants of your farms, and the circumstances by which you are surrounded; and if you cannot do it at once, work with that end in view." And let me here say that the circumstances are what shall determine whether he shall keep more of cattle, sheep, or swine. I shall limit my paper, however, to cattle, and as we pass, let us notice some of the circumstances that surround the farmer showing how difficult to answer this question, telling "what stock he should keep."

1st. He is to consider whether he is near enough to market for profit.

2d. What that market pays best prices for.

3d. Whether there are strong probabilities of a stable market, and a permanent call for some particular product.

4th. Whether his farm is adapted to the product called for, and can produce it with profit.

5th. Whether he is able to provide the proper care, buildings, shelter, etc., that some of these breeds require.

All or nearly all of these conditions enter into the scale when weighing the arguments for or against certain breeds of cattle.

But why keep pure-bred cattle instead of natives? Some one may say, we often have native cows that are as good milkers as your pure-bred animals and just as large and handsome. I would say because there is no fixedness of type among natives, and they do not transmit their characteristics with any certainty to their offspring. Farmers in breeding native cattle will generally take any animal that is fine looking from which to breed regardless of points that he wishes to perpetuate. The law that like produces like will not work with much certainty, but he will very likely have in his herd cattle representing different characteristics for a dozen generations.

The various breeds have been brought to their present perfection by a long, studied, and systematic course of breeding, and some of the experience has been dearly bought. Mr. John Price, the great Hereford breeder, tried his hand for a time and by making one cross to increase the size of his cattle lost all the labor of years and was compelled to return to his original selection and stick to it. In Short Horn breeding, Charles Colling, who first brought the race into prominent notice, took the utmost pains to find the finest cattle, and gathering the cream of the best tribes in the north of England, he developed his herd to which as a pure fountain we trace all the best blood of to-day. Many of these animals were from herds that had been bred carefully for many years. For instance,

Bates' famous Dutchess tribe is said to have been descended from the herd of Sir Hugh Smythson, and Colling himself says that one cow was particularly fine, and was better than any he could get from her, although bred repeatedly to his best bulls. Mr. Price's Herefords were descended from two heifers and a bull selected by him from the herd of a Mr. Tompkins of Wellington Court, who had kept them pure for over 40 years. Mr. Price bred them pure for over 40 more, so that for over 80 years, the character of these cattle was being fixed by careful breeding. This gives you some idea of the time, trouble, and expense incident in forming a breed or race of cattle and bringing them up to a high standard of perfection. To quote Prof. Jamieson of the University of Aberdeen, he says: "It is only by continued propagation from the same sort that fixity of character can be obtained; and every mixture of fresh or foreign blood introduces unlooked for elements of confusion." This fixity of character was secured and transmitted by such bulls as Hubback, Colling's Favorite, Foljambe and Belvidere, among Short Horns, and Quartly's Prince of Wales, Hundred Guinea and others among Devons.

But may not farmers succeed by getting pure-bred bulls and grading their stock? They may, to a certain extent, provided they always adhere to the rule to use a pure-bred male and never a grade; as the moment you use a grade, you lose that potency of transmission so essential in the breeding of stock. This is a slow method of improvement; and where able, how much better to get pure-bred females as well as males and rear herds that shall be our pride. The most common use of grades is to make one cross with a Short Horn bull and then sell for beef, or one cross or two with an Ayrshire and keep the heifers for milk.

There is another element that enters into the breeding of grades, and that is the influence of the first gestation on future progeny. It is a well established fact, among breeders, authenticated by numerous instances, that a female first bred to a male will have her future progeny carrying more or less of the characteristics of the first male to which she was bred.

This has been the case among hogs on the College farm. You see that for one to succeed in grading cattle well, he should take heifers that have never bred and from these start the herd, breeding continually in the same line and with the same end in view.

But indiscriminate breeding, as crossing first with Short Horn, then with Ayrshires, and after perhaps with Jerseys to get, 1st, size; 2d, quantity of milk; and 3d, richness, would not be apt to meet with very marked success, as I have seen by my observation in one instance at least. But why do anything better than grade stock, if good results can be reached by doing that? Because every man should do the very best he can; and if able, it is much better to raise pure-bred cattle than grades. Besides some one has to raise the pure-bred bulls that are used for grading. These do now and probably always will command remunerative, if not fancy prices, so that it will pay well to breed such stock. There will always be some farmers who are not able to get and breed pure stock on account of the prices and the state of their finances, so that the market will be good for those who are able. As an earnest of this I have but to quote the result of the fall series of sales extending during fifteen days, in the blue grass regions in Kentucky, at which over one-half million dollars' worth of stock changed hands, and it is congratulatory to the Short Horn interest that it stood this transaction and was carried through with no apparent decline, and it is said that prices even seemed firmer and estimates higher at the close than when they opened.

Many people supposed that when the New York Mills sale occurred about two

years ago, it was a kind of gambling operation, a regular speculation, and set it down as one of the things never to occur again. But we find this series of sales in Kentucky after two years and average prices fully sustained, and this in the face of the fact, that times are hard, money close, and likely to be so for a year or two to come, or till we get back to a sound specie basis. Some men think it will not pay to put a valuable animal at the head of their herds. I will only refer to Mr. Megibben who paid $12,000 for the Short Horn Bull 2d. Duke of Oneida who says he has more than realized this sum yearly in additions to and sales from his herd. This is only one instance of which many could be given.

But to return to our question;—In keeping pure-bred stock what should be selected? Perhaps you are already prepared in part to anticipate me when I say that each farmer must answer this for himself. I will, however, give a few remarks on the capabilities and adaptabilities of some of the various breeds which may aid you somewhat in your decision, and first I will speak of the Short Horns. They are no doubt the finest grazier's stock we have; and for quantity and quality of beef, cannot be excelled. They were at first good milkers, giving frequently 24 qts. daily. Emerson says of them, "They have been celebrated for ages as possessing extraordinary value as milkers, in which quality they have never been excelled; but when put to fatten were found slow feeders, producing an inferior quality of beef." This you will observe is entirely different from the present Short Horn cow, that has been so improved that her progeny at two or three will fatten as readily as most breeds at four; and this quality of early maturity and fattening is what makes them in so good demand as butcher's stock and causes them to command from one to two cents more per pound in market than others. But while breeding for these qualities others have been neglected until in many of the highest priced families many of the cows will hardly give milk enough to raise a calf well. Youatt says: "The carcass has ever been so surprising, and justly valued, that many persons have allowed that to completely occupy their attention, and the dairy has been disregarded. In such a state of things every advance toward one point has been to recede from another." In fact almost every farmer knows how difficult it is to fatten a cow with excellent milking qualities; while one that is a poor milker fattens quite readily. Their merits as working cattle are not great, as the quiet, lethargic temperament, which comes from their fattening qualities, makes them slow and unprofitable. Indeed it is rather doubtful whether as a whole they would be the cattle for raising, among a majority of Michigan farmers. The good farmers may raise them successfully, but even then unless given excellent care, they will not do as well as in the blue grass region in Kentucky, where the climate is more nearly like that in the valley of the Tees in England, where they were bred for two centuries. The Devons are better adapted to hilly and scant pastures and will thrive with less care. They are beautiful cattle; not large milkers but the milk is richer than that of most other breeds; and some families even with careful breeding have yielded largely. As a breed for general use, they recommend themselves as combining labor, milk and beef, in not large, but fair paying proportion. They are hardy enough to suit our climate, and as working oxen cannot be excelled.

The Herefords are larger than the Devons and rather poor milkers, as a whole. They are larger boned than the Short Horns, though equalling them often in weight, and are said to furnish a fine quality of marbled beef.

The Galloway's, or Polled Cattle, are a race that originated in Scotland; are hardy, rather small in size, medium milkers, and make excellent beef. They

thrive well on rather poor keep and care, and for a breed for the northern part of our State while yet new and undeveloped, I should think would give good satisfaction. It is said that in London, fine Galloway steers command the highest market prices.

The Ayrshire is really the dairy breed, and as such recommends itself to all who want to make dairying for butter or cheese a primary object. They are in some cases extraordinary milkers, and one writer says second to none for milk. Mr. Ayton, a Scottish writer, who is thoroughly conversant with the facts, says of them: "They are brought to a degree of perfection that has never been surpassed as dairy stock in any part of Britain, or probably in the world. They have increased to double their former size, and yield from 4 to 5 times as much milk as formerly. By greater attention to breeding and feeding they have been changed from an ill-shaped, puny, mongrel race of cattle to a fixed and specific breed of excellent color and quality." The chief quality of a dairy cow is to give milk in large quantity, and when old enough to turn off, to fatten quite readily and make good beef. In all these respects the Ayrshires are equal to and in most cases excel every other breed in a combination of the three qualities, milk being the first and chief. They are well entitled to the first rank of dairy breeds, being tame, quiet, and hardy, and the quantity and quality of yield being considered with amount of food required. Compared with the Jerseys they may safely be called first, as the milk is so much more abundant, and richer in caseine (the cheese-producing element). It, however, has not so much oily matter as Jerseys, but is as good as the average of other breeds. Mr. Sturtevant, a gentleman who has examined the milk of the dairy breeds, viz., Jerseys, Ayrshires, and Holstein cattle, making many experiments, among which were the quality, size of milk globules, quickness of cream rising, amount of butter, color, texture, &c., &c., also the same with cheese, makes this summary: As to size of globule: 1st, Jerseys; 2d, Ayrshires (butter family); 3d, Ayrshires (cheese family)—they having been bred with reference to butter or cheese in two families by some breeders; and 4th, Holsteins. The properties of the milk; the rapidity of cream rising: 1st, Jerseys; 2d, Ayrshires; 3d, Holsteins. The rapidity of churning: 1st, Jerseys; 2d, Ayrshires; 3d, Holsteins. The value of the milk for cheese: 1st, Ayrshires; 2d, Holsteins; 3d, Jerseys. Qualities desirable for milk retailers: 1st, Ayrshires; 2d, Holsteins; 3d, Jerseys. As to quantity there is no superiority of Jerseys over the Ayrshires; and quality is more a matter of taste and preference. Which of the two breeds is preferable is more a question of locality and other circumstances, than one of quantity and quality of milk. It is generally conceded by those competent to judge that the Jersey cow is best fitted for a village resident or a suburban locality, where special facilities are offered for the disposal of the butter at high rates, or for an amateur farmer, who does not care so much for profit as to show a fine herd and have the richest, creamy milk for table and family use. There is this difference however: The Jerseys are rather tender, and need the best of care, as they are rather subject to colds and consumption, while the Ayrshires are hardy and will subsist well where Jerseys will scarcely live. The transition from the climate of the Isle of Jersey, in the English channel, to ours is too abrupt. Indeed, Mr. Culley says that there is not much use in British farmers getting them, as they will hardly stand the climate, especially in the northern part of the British Islands. How much worse is the change to the cold of one of our northern winters, especially if we have such an one as the last! After two or three generations the progeny may become so acclimated that they

may endure tolerably well (as the weak ones will die), and thus, by a process of natural selection, we may get Jerseys that our *good* farmers can raise and keep profitably. But we will have to watch closely, lest in the process they do not lose some of their milk and butter producing qualities. Flint, in his Dairy Farming, says that the transition is so great with the Ayrshires that they do not develop as they do in the moist English climate, and in consequence we do not hear of any such remarkable productions of milk in this country as in Scotland and England. I present you a few figures giving yield of Ayrshire cows in New England: "Beauty," of Maplewood herd, Fitchburg, Mass., gave in 1869–70, 8,011 lbs. of milk; in 1870–1, 7,922 lbs.; and in 1872–3 she gave 7,555 lbs., or an average of 7,829 lbs., or about 3,608 quarts per year for 3 years. She gave milk 326 days each year. Queen of Ayr, a cow of Waushakum herd, South Farmingham, Mass., 6 years old, gave in 1870, 8,596 lbs.; in 1871, 7,135 lbs.; an average of 7,865 lbs., or 3,624 quarts a year of 327 days, or over 11 quarts daily. Five cows in 1870, a year of exceptional dryness, 6,984 lbs., average, a piece; in 1871, the year of remarkable drouth, 6,099 lbs. each. This will serve to show you how important to keep the best cows of a breed, as well as the best breed for your purpose. A few more facts and figures and I will close. In an experiment on the Earl of Chesterfield's farm, Bradley Hall, I find the following comparisons of breeds:

Breed.	Quarts Daily.	Ounces Butter.	Ounces Per Quart.
Holderness	29	38½	1.33
Alderney (or Jersey)	19	25	1.31
Devon	16½	28	1.6
Ayrshire	20	34	1.7

This was in the heighth of the feeding season. Red Rose of Ayr gave a high as 84 lbs. some days, and from July 1 to Sept. 4 the greatest yield 75 lbs. and the least 50 lbs., 3,956 lbs. in all averaging nearly 62 for that time. You can easily see how much more profitable it is to keep one good cow that will yield as much as two ordinary cows, even if she consume one-third more food, and I would urge on all, the necessity of feeding well. Do not look upon stock that consume a great deal as expensive. They should be as they are, machines to work up the products of the farm and turn them into more salable products, and also manure; as not without liberal supplies of the latter, can any farmer hope to succeed well. One reason why farmers do not succeed with pure-bred stock, is, that they expect the pedigree and name of the breed to half keep them.

It is only by high feeding, particular care, and weeding out all poor and ill-matured animals, that any breed has been improved. And can we expect to stay where we are if we do not adopt the same measures. I tell you nay. And just here is where the education of the farmer comes in to help him, for often times he has to grope along for years to gain the knowledge and experience that he could get in a four years' course at an Agricultural College. When educated the farmer goes to work more intelligently, more interestedly. He would have pleasure in these things beside the mere matter of dollars and cents. One thing that is shown very strongly, in our Agricultural College graduates, as soon as they settle on farms, is, a desire to have better stock, and to keep it better than those by whom they are surrounded, who have been working along in the same old routine for years. I would like to have a voice that could reach

every farmer in our country and urge them to educate their sons for the farm. Give your smart boys an agricultural education and they will stay with you.

It takes smart boys to make good farmers. The idea that farmers do not need to think much, and that they have an easy vocation, is false; for nowhere is there a field so broad, and so little worked over. Other professions take up only one particular line,—ours embraces all.

In conclusion let me say,—let us go to work earnestly to improve our soil, our stock, and our homes, and we will succeed better than our most sanguine expectations.

Where there's a will there's a way.

THE PROSPECTIVE BENEFITS OF THE CENTENNIAL EXHIBITION. AN ADDRESS DELIVERED AT THE FARMER'S INSTITUTES HELD AT ARMADA, ROCHESTER, AND COLDWATER.

BY R. G. BAIRD, SECRETARY OF THE STATE BOARD OF AGRICULTURE.

We have recently entered upon the centennial or one hundredth year of our national existence. I have never seen but one individual who had lived a hundred years, although I see from the recently published census for 1874 there are 18 males 100 years old or over in this State. Probably of the 4,772 females who are reported as 75 and over, a few may have reached their hundredth year. The census, with a modesty that amounts to a defect, has not chosen to disclose the age of those matrons so far advanced in life. Perhaps it was feared that it might endanger their matrimonial prospects. If such were the case we have no fault to find. The life of a nation, however, is a very different thing from the life of an individual. The centennarians whom we may, though rarely, meet, are bent under the infirmities and decrepitude of years, whereas our nation, at this its first centennial, has hardly cast aside the swaddling bands of its infancy. It is very remarkable, in view of the vast progress which has been made during the past hundred years, that there will undoubtedly be some who shall witness its centennial celebration whose birth antedates the Declaration of Independence. I think, however, we had better try to attend the celebration at Philadelphia this year, as we may possibly not be here when the next centennial comes round.

As it is proposed to celebrate the one hundredth year of our national existence by an international exhibition which will, in all probability, surpass in magnitude anything of the kind which has preceded it; and as a vast amount of money must of necessity be expended on the enterprise, it may be well for us to ask what is likely to be accomplished by it, and whether the benefits resulting will be such as to justify so vast an undertaking. With regard to these results we can speak with some degree of certainty, as this is not the first international exhibition. The experiment has been several times repeated since Great Britain twenty-five years ago erected the Crystal Palace in London, and invited other nations to exhibit within its walls the products of their wealth, and enterprise, and skill; and the nations that participated in that and subsequent exhibitions carried away from them more practical wisdom than centuries would have evolved without some such opportunities having been presented.

Whatever may be the characteristics of our age, certainly stagnation is not one of them. An enlightened spirit of inquiry is almost universally elicited. The progress of the present century is not to be traced to a mere love of change, but to a more systematic course of observation, and an earnest desire to learn whatever can be known. This anxiety to learn is an essential element of progress. We are not going to erect these immense structures at Philadelphia and invite the nations from across the Atlantic and Pacific to come over and see how big a spread we can make; if we were to do this we should come out of the undertaking as ignominiously as did "Darius Green with his flying machine." We shall invite them to come hither believing that while there are some things they can learn from us, there are many things that we may learn from them. We ask them to come and place their productions side by side with each other and with ours, under the certainty that each will have something to teach and all a great deal to learn, and knowing also that universal progress will be accelerated by collecting under one focus the materials, which shall afford so grand an opportunity for the intelligent observation of men of learning, men of science, and men of practice, and knowing also that under such circumstances there can not fail to be poured out upon that vast assembly representing every nation under heaven such a measure of the spirit of honorable rivalry as shall call forth their latent genius, and arouse whatever is dormant of their industrial capacities.

While international exhibitions exert an important influence in advancing all that pertains to the highest forms of civilization, they are also the product of a civilization already in many respects far in advance of anything that the world has formerly known. Our ancestors were familiar with the idea of holding fairs, but these fairs were very different in their nature and object from an industrial exhibition. They were designed to facilitate the coming together of buyers and sellers, and so to promote the interests of private individuals. They were necessitated by the want of an easy and extended method of communication. An industrial exhibition like that to be held at Philadelphia, is the result of the most extensive facilities of intercommunication. Without the steam engine and its application to the transportation of the products of industry such an industrial exhibition would be an impossibility. Thus, while it will exert an important *educational* influence upon the nations participating in it, giving them aspirations after higher achievements than they have yet attained, it is also a result of great achievements in the past.

In turning now to consider more specifically some of the benefits likely to be derived from the Centennial exhibition, let us begin with the individual, gradually widening our circle of vision to the State, to the nation, and to the great inter-community of nations, the world.

Suppose that you and I were to start off on a trip to Philadelphia some time after the exhibition has fully commenced. We would go with all these prejudices about other nations, and inflated ideas about ourselves that we now have just because we do not know any better. A great deal is said about national pride and conceit. I do not think there is so much of that, but there is a great deal of ignorance of other nations. It has been said of Charles Lamb that on one occasion he was berating somebody most severely, and on being asked whether he was personally acquainted with the individual, replied no; certainly not. If I were, I should undoubtedly think better of him. The average American has some prejudices to be overcome. He thinks of John Bull as a surly, disagreeable sort of fellow who does not know half so much as he thinks he

does. Of the Scotchman as a slow-motioned being, with nothing more remarkable than a large development of caution and Calvinism. Of the Irishman as skilled only in the use of the shovel and the shillalah. Of the Frenchman as one who has more manners than brains; and of the German as living in a realm of mysticism, metaphysics, and tobacco smoke. How many of us do not know, or at least do not reflect, that these nations far outstrip us in many of the mechanical arts, and are all the while finding a market here for many products of their industry because we cannot manufacture them ourselves, —the shawls, and laces, and broadcloths, and silks, and hundreds of other articles that we wear and use, but cannot make; and if we go to Philadelphia, as we walk along the compartments occupied by these nations, we shall open our eyes in wonder and admiration at the taste and skill manifested in many of the articles of use and adornment which they shall exhibit there; and I think we shall conclude that if we are the greatest, and smartest, and best looking people in the world, there are some others that we cannot afford to laugh at. Soberly, we shall discover that we knew comparatively nothing of the productive capacities or the industrial progress of other countries, and we shall be astonished at the perfection and finish of articles wrought by nations that we esteemed almost barbarians, and ever after we shall have a truer, wiser estimate both of ourselves and others.

It must be well nigh impossible, we think, to contemplate such a vast collection of the articles produced by human industry and skill as shall be exhibited at Philadelphia without realizing that we are thereby made not only wiser, but better also. Rightly understood, there is a vein of true philosophy in the old Scotch woman's prayer: "Lord, give us grace to think enough of ourselves." As the invisible God is made known to us by the visible things which he has created, so we are enabled to come to a truer, grander conception of the human mind, through the varied and wonderful results which it accomplishes. By such an exhibition of the myriads of modifications of the powers and action of mind, we come to realize what a wonderful and glorious thing the human mind is. And then think what an incentive is thus given to the more perfect cultivation of its powers. For, wonderful as the mind is, its chief glory lies in its capabilities of growth. How comparatively little man utilizes in a savage state. The grand achievements of mind come through observation, and habits, and processes of thought. When we look at a piece of machinery cunningly contrived, elegantly finished, perfect in its adaptation to some particular use; or look upon some article of beauty which the human mind first conceived, and then the human hand fashioned, we seem to rise into a higher atmosphere. And when such influences are brought to bear upon, and are made to work simultaneously in the masses of the people throughout the world, who can estimate the beneficial result?

We are made to feel also that a common end animates all the myriads of the noble army of workers throughout the world. All are laborers in a common field, and though occupied in widely different departments, all are obeying the divine command, to have "Dominion over the earth, and subdue it," for as it has been truly said, "When we get at the secrets of nature, and expound them; when we lay hold of the powers of nature, and employ them; when we take possession of the riches of nature, and dispose of them; when, in the temple of this earth, we take our place as priests and as ministers, then industry performs its mighty work, and fulfills its high destiny."

Passing from the *individual*, allow me to notice the benefits that may accrue

to our own State from the Centennial exhibition, if as a State we are sufficiently wise to make the best of a grand opportunity. It is a manifest fact that Michigan has not received anything like such large accessions of population and capital from immigration in the past as it ought to have done in view of its varied and ample resources—which, if more extensively known and appreciated, would make the territory within its borders a peculiarly inviting field for the immigrant in which to make his home. What we have retained in our midst of the great stream of immigration that has flowed past or through our borders, pouring itself into the great prairie States of the West, has been as it were but a few drops of the stream. This cannot be accounted for by our geographical position. So far as that is concerned we are most favorably situated to receive the flowing tide. One of the principal reasons no doubt is the fact that Michigan has never been as thoroughly known to the great outside world as it ought to have been, and during its early history was very *unfavorably* known. It was common to speak of Michigan as an extensive wilderness infested with ague and wolverines.

The following sentence is from a lecture delivered a number of years ago in Exeter Hall, London: "We read that in America there is a certain district called Michigan, so swampy and so vexed with ague that in one village the bell rings at twelve o'clock every day for the people to take their quinine." If that was what the people of the old country were reading and hearing about Michigan, we do not wonder that their emigrants should want to stop before they came as far as Michigan; and if from choice or necessity should go further west that they should hurry past us as rapidly as possible, scared by the ghostly spectre of our ague-breeding malaria. Now, whatever remains of these old notions among foreigners, which, in their application to our present condition at least, are as erroneous as they are injurious to us, the Centennial Exhibition will give us a grand and rare opportunity to remove.

The last Legislature authorized the Governor to appoint a Board of Managers, consisting of four persons, representing the Agricultural, Pomological, Mining, and Manufacturing interests of this State. It is the duty of this Board of Managers to supervise the transportation and provide storage at the place of shipment for such works of art or products of the soil and mine or manufactures as individuals may desire to send. It is also the duty of these managers to make such arrangements for freight as may be most advantageous to exhibitors.

Now, amongst all our industrial organizations, the State Agricultural Society, the Pomological Society, the lumbermen of the State, and the owners of mines, and the different branches of mechanical industry, should all be animated with a spirit of honorable rivalry,—each resolved to do its best, and if possible to outdo the others, provoking one another to devise large and liberal things,—that Michigan may be represented as she is worthy to be in that exhibition. Given the necessary means, and good judgment and honesty in their expenditure, and there is no reason why Michigan should take a back seat in that exhibition. She may stand proud and pre-eminent among this grand union of States. We may exhibit almost every variety of soil, showing that we have lands that invite the horticulturist, pomologist, the agriculturalist, the dairyman, and the stock breeder to the expenditure of capital and labor, with the certainty of a large return. For many varieties of fruit, and these among the most profitable to cultivate, this State is not excelled, if indeed equalled by any other in the union.

We have ample forests producing some of the most useful timbers in the world. We are not particularly anxious that these forests should be cut down;

still, in some of the newer portions of the State where the settler's great object is to make a clearing, there is enough being destroyed every year, that with the investment of capital to work it into articles of utility, would give ample return and profitable employment to many. We have rich mines of silver and copper, and iron, particularly the latter, that will not be exhausted for ages. We have, in short, extensive undeveloped resources, which, if fairly represented at the Centennial Exhibition, must appear inviting and attractive to European capitalists. A larger number of foreigners will visit this country during the approaching summer, than the total number for many years past. A large proportion of these visitors will be capitalists; and finding in our undeveloped resources opportunities for the investment or employment of capital, with the certainty of a larger return than is possible in any of the older countries of Europe, may be induced to take up their abode here, or, if not remaining, may form business connections with the country which shall be advantageous both to us and them.

As the primary object of an exhibition is to exhibit, we hope Michigan will not fail to improve this golden opportunity of being represented, where it will so materially affect her interests, in such a way as she ought to be represented, and can be if her people set about it in earnest. The *people* should be seen there as well as their productions; and when the people of other countries see from Michigan as healthy and enterprising, intelligent and industrious a people as are to be found anywhere, they will learn that we have driven ague and malarious fevers from our abodes almost as effectually as the beavers of our primeval forests.

Let us now consider briefly some of the benefits of the Centennial Exhibition with reference to the nation at large. As the individual is a part of the State, and both are parts of the nation, and as the nation is the aggregate of the individuals and States, the benefits derived by each are to a certain extent participated in by all. We propose now, however, to notice some of those collective benefits which must affect us nationally or through our national institutions. An international exhibition furnishes a powerful incentive for international visits. The representatives of all, or nearly all, foreign nations will visit this country during the approaching summer. Thus *we*, on the one hand, shall have an opportunity of studying not only the articles exhibited, but also the individuals exhibiting them, the differences and resemblances of national characteristics. They, on the other hand, will have an opportunity of studying not only us and the articles we exhibit, but also the institutions which they see in operation here. Our government and national laws will be scrutinized and compared with those of other countries. The respective merits and defects of representative and despotic rule, the comparative effectiveness of the machinery of the State to promote public security, the distinctive marks of religion and morality, the evidences of intelligence among different classes, our system of education, the extent of crime, and the nature of its punishment,—these will all be carefully noted, and appreciated.

One of the results likely to be secured by the exhibition is the impulse it will undoubtedly give us as a nation in the improvement of our educational system as related to our varied industries. With regard to technical or industrial education we are, it must be admitted, lamentably deficient as compared with the countries of Europe and with Great Britain. This deficiency is all the more remarkable when we consider the importance which the average American attaches to the idea of money making. Mere culture and intellectual distinc-

tion are hardly in themselves sufficient to induce him to devote a number of years to acquiring a higher education. He must be satisfied that the years thus spent will so enlarge his facilities for making money as to enable him to take a position among the men who are considered financially a success. And yet it is precisely with regard to this that our educational system is most defective.

Besides her distinguished universities, in which are taught science, letters, philosophy and religion, Europe is dotted all over with schools and colleges whose aim is to impart that training which will enable their graduates to reach the best and highest results in every department of industry. Teaching farmers how to improve all the varieties of domestic animals, and how to make the soil yield the best products in the largest quanties. Teaching the miner how to procure, and the metallurgist how to use the products of the mine. Teaching the manufacturer how with the least expenditure of time and money to convert raw material into articles of utility and ornament. Teaching the mariner how to navigate the ocean and protect the rich commerce under his care; teaching the engineer how to overcome apparently insurmountable obstacles and make a highway for commerce through mountains and over rivers.

The principle on which all such institutions of technical learning are founded, and which governs the nature and methods of their instruction, is that intelligence is the most essential element of progress. That it is just as necessary for the farmer to understand the sciences related to his department of work and so of the workers in all the other branches of industry, as it is for the physician, or lawyer, or preacher, to be intelligent in their departments.

In this country we can hardly be said to have more than made a beginning in regard to technical education. There are a few technological schools and colleges in the eastern and in some of the middle States. Several States have embarked on the experiment of agricultural colleges, encouraged by the grant of land for that purpose by the Federal Government. Our own State, we believe, has the oldest and most prosperous Institution of this kind in the Union. The last Legislature authorized the Board of Regents of the State University to establish a school of mines in connection with the polytechnic department of that institution, with at least three professorships: one in mining engineering, one in metallurgy, and one in architecture and design. Schools of this nature are yet in their infancy with us. A manufacturer of New England recently declared that the designs for their establishment cost them forty-five thousand dollars a year, every dollar of which went to England, France, and Germany. Says a recent writer on Art Education in the International Review: "It is a fact full of significance to the United States, which has all the natural resources to lead the civilized world in manufactures, that the nation (the United States) which made the poorest exhibition of industrial products at the Universal Exhibitions of 1851 and 1867, made also the poorest exposition of industrial schools at home; and that the countries which gave to the world the richest silks, the costliest carpets, the most valuable woolen fabrics, the best cotton prints, the most artistic productions of the pottery, the glass factory, the bronze foundry, and the marble works, also have built the most and the best industrial schools." I am full of hope that our country will derive large benefit from the exhibition in regard to this matter. We shall doubtless find that although we have been making considerable progress we are still excelled by other countries in the production of many articles, particularly those whose value depends largely upon their *artistic* perfection. But we are not the people to sit down on the word impossible, and get discouraged because we are beaten. We shall do as England

did after the exposition of 1851, when, says the writer from whom we have just quoted, "the English manufacturers were amazed at the beauty and grace of design shown by many articles of continental manufacture, and were especially humiliated by the marked contrast between foreign earthenware and glass and the English collection, which, said Mr. Russell, 'disgusted the whole nation with its blue earthenware plates, cups, and saucers, borrowed from the two thousand year's tradition of China, and with its huge lumps of glass called decanters, and glasses cut or molded into hideous distortions of form.' This inferiority was wisely attributed by Prince Albert to the lack of art education, whose earnest efforts were at once directed to the establishment of art schools in the manufacturing districts. So soon did these young institutions bear fruit that in the next exposition in 1855, England, in the opinion of Mr. Russell, was no longer outstripped in pottery and glass; and when, a few years later, a commission came from France to ascertain the cause of this marked progress, they went home and pointed to the English art schools and the South Kensington Museum as a sufficient explanation." At the time of the first exposition in 1851, industrial art schools were hardly known in England. From that time their number increased rapidly, and twenty years after they could boast of "one hundred and twenty-two special art schools with nearly twenty-three thousand students, and five hundred and thirty-eight night classes with more than seventeen thousand students, while nearly two hundred thousand children were taught drawing in the public schools without charge." The centennial exhibition will, we have no doubt, vividly impress upon us the necessity of such schools in this country, the establishment of which would ere long be an annual saving to the country of millions of dollars.

It is not to be overlooked that the exhibition will undoubtedly exert a beneficial influence in promoting intellectual and moral refinement. A nation's real wealth consists not so much in its forests, and mines, and fertile lands, and railways, and manufactories, and public institutions, and palatial residences, as in the character of its people. That is a low and sordid view of national greatness and prosperity in which money and possessions of a material kind are regarded as of greater importance than the high and noble qualities of character that may be developed in the citizens. "You will confer," says Epictetus, "the greatest benefit on your city not by raising its roofs, but by exalting the souls of your fellow-citizens, for it is better that great souls should live in small habitations than that abject slaves should burrow in great houses." As industry goes everywhere hand in hand with godliness, it is evident that whatever tends to quicken the pulses of national industry will tend to the elevation of national life. Then the fact of the extensive intercommunication and associations with the representative men of the most advanced and progressive nations of the world, occasioned by the exhibition, cannot fail to leave behind it an elevating and refining influence. To many a soul struggling on amid difficulties, by which it is often well nigh overborne, it will be the commencement of a new era of hopefulness and success. Seeing what others have accomplished they will work with a new confidence in those faculties which give man power over the numberless objects of nature to fashion them as he pleases, and make them subservient to his uses.

We hasten on to notice before closing that an international exhibition regards man not so much in his individual capacity, or even nationally, so much as in his universal relations. It is designed not to benefit one particular nation merely, but the world, the most distant parts of which need to be brought in

contact with each other. The world's vast riches and storehouses of production are the gifts of one common Heavenly Father allotted to his children, spread over every zone and every clime. And what can be more conducive to the universal good than calling all nations to take their place side by side in the arena of industrial rivalry? To the extent that the appeal shall be answered, the benefits will be realized, and that will be by a belt of nations encircling the globe. Every State in this grand union will be there. All the provinces of the Dominion of Canada will be there, and they will more than astonish those of their boastful American cousins who have never attended any of their provincial industrial fairs. Central and South America will doubtless put in an appearance with their rich tropical productions; and Europe, from the Islands of Great Britain, washed by the waters of the Atlantic, to the Japan Islands, washed by the waters of the Pacific, will be represented there. Imagine, if you can, P. T. Barnum's grand hippodrome representing the varieties of national life and character magnified a hundred thousand fold, and you will approximate to some idea of one particular aspect of that exhibition.

It is impossible to conceive of this commingling of nations for the purpose of exhibiting the products of their soils and their industries without regarding it as a great promoter of peace and good will among the nations of the earth.

Again, international exhibitions will undoubtedly hasten the removal of various things which now prevent the most extensive intercourse of nations. One great hindrance to the perfect understanding of the institutions and characteristics of other countries is the want of a common language.

Since the days of international exhibitions, the attention of nations has been directed to this hindrance, and suggestions have been made with reference to its removal. The difficulties experienced from the want of a common language are very great. Some one has suggested that an agreement should be generally entered into to adopt one language as the second language to be taught in all lyceums, schools, and colleges, which second language should be taught concurrently with the language of the nation. Thus, while each nation would preserve its own language, they would at the same time have at their service a second language which all would understand, and of which all might make use. Much would be gained also by unity of money, and the universal adoption of the decimal system of weights and measures. A common meridian also should be agreed upon, thus obviating many difficulties of calculation connected with philosophical research. It has been well said, "Nations are divided among themselves only because they do not understand each other,—because the confusion of hundreds of different languages hinders them from communicating to each other their ideas, and their aspirations, and to make known to each other their wants and their interests. Let them have the means of understanding each other, and all barriers will disappear, rivalries will be smoothed, hatred will be extinguished, prejudices will vanish, a rich emulation will replace the antagonism which has so often caused destruction and mourning. War, that bloody scourge and deplorable relic of barbaric ages, will eventually become an impossibility, and the civilized nations of the globe united into one common thought, animated by one similar principle of intellectual and moral life, will march together in a steady and uninterrupted step toward those great and mysterious destinies which a Christian civilization opens to the modern world."

And now, having sketched some of those benefits likely to flow from the great undertaking which is to crown our centennial year, let us ask ourselves in conclusion to what final issue does such an assembling of the nations point? Who

can fail to discern this finger on the dial-plate of time, pointing to the approaching era of the perfect unity of the human race? Whether this consummation be remote or near at hand, we surely cannot fail to discern its approach. Large portions of the world, it is true, are yet to be civilized. Wars and rumors of wars may yet darken the horizon, and spread wretchedness over portions of the earth. Ignorance may yet be too visible in our communities. But let us be patient and look forward; nay, let us so act as to help forward the glorious consummation when the elemental chaos shall arrange itself into definite shape, and the millennial glory overspread the world. Great God of heaven! is it a delusion of the fancy, or hast thou established laws from the creation of the world whose slow but continual action is at length to evolve this mighty transformation? Shall nations at length revolve without jar or collision around the great sun and center of their common attraction, which is an all-dispensing light and peace and joy, while each of those nations, like so many planets, is internally assuming the form and structure best calculated to secure its future stability, and contribute most effectually to the universal good? We shall gladly cherish the belief that the world is hereafter continually to become wiser, better, happier, and more free. When the Crystal Palace in London was opened in 1851, and the representatives of about fifty nations were assembled under its vaulted roof, the following prayer ascended to heaven, which embodies what we hope shall be realized from our centennial exhibition: "Now, therefore, O God we thank Thee, we praise Thee, and entreat Thee so to overrule this assembly of many nations that it may tend to the advancement of Thy glory, to the diffusion of Thy holy word, to the increase of general prosperity, *by promoting peace and good will among the different races of mankind.*"

THE APIARY.

BY PROFESSOR A. J. COOK.

PREFACE.

The following is, in substance, the same as the course of lectures which I have given each term to the students of the Michigan Agricultural College, and their desire, as expressed in repeated requests, has led to this publication.

In considering the various subjects of interest to the bee-keeper, I am greatly indebted to Langstroth, Quinby, King, Bevan, and Hunter, and also to the following journals, all worthy of high commendation: Gleanings in Bee Culture, American Bee Journal, Bee-keepers' Magazine, and Bee World.

The illustrations for this manual were nearly all drawn by the author from the natural object. The engravings were made by Miss S. E. Fuller, of New York, whose great skill is very worthy of high praise.

Figs 1, 3, 4, 17, 18 and 19 were kindly loaned by Luther Tucker & Son, of the Country Gentleman, and are from those volumes so valuable in every practical library: The Illustrated Annual of Rural Affairs.

CHAPTER I.

INTRODUCTION.

WHO MAY KEEP BEES?

Those of any profession or business,—who can give a little time in spring, summer, and autumn, who may desire to be associated with, and study natural objects, and supplement their present means of increasing their income,—provided, they have a little ground three or four rods from the street. Thus, citizens of country, village, or city, male or female, who wish to add to the pleasures and profits of life, will here find an ever-waiting opportunity. To the ladies, so often shut out from fresh air and sunlight, till palor and languor point sadly to departing vigor, and to those men, the nature of whose business precludes air and exercise, the apiary offers special attractions.

INDUCEMENTS TO BEE-KEEPING.

This has been called the poetry of rural pursuits, and very properly too. There is a fascination about the apiary that is indescribable. Nature is always presenting the most pleasurable surprises to those on the alert to behold them.

And among insects, especially bees, the instincts and habits are so inexplicable and marvelous, that the student of this department of nature never ceases to meet with exhibitions that startle him, no less with wonder than with admiration. Show me a scientific bee-keeper, and I will show you an enthusiast. A thorough study of the wonderful economy of the hive, must from its very nature go hand in hand with delight and admiration. Said I, a short time since, to an extensive apiarist who also owns a fine large farm, "Why do you keep bees?" The reply was characteristic: "Even could I not make a good deal the most money from my bees, I should still keep them for the real pleasure they bring me."

Again, there is no other manual labor pursuit in which the returns are so large, compared with the labor and expense. An experienced apiarist may invest in bees any spring in Michigan, with the absolute certainty of more than doubling his investment the first season, while a net gain of four hundred per cent. causes no surprise to the bee-keepers of our State. During the past season an investment in bees has returned to me five hundred per cent., and though this has been a good season for honey, yet I have done better than this several times. No less than three farmers of our State who possess good improved farms, and also keep about one hundred colonies of bees, have told me within a few weeks that their income from their bees far exceeded that from their farms. What greater recommendation has any vocation? Money getting, even with the greatest privations is attractive, and is slighted by *no* class. Money getting, with labor that brings, *in itself*, constant delight, leaves little to be desired.

Bee-keeping, too, on a limited scale, demands very little time; and since the pleasures would be just as great with but few colonies, no one would object to thus add to his income. I know, in fact, of no business (and I speak from experience) that is so convenient and desirable as an avocation. To the man with sedentary habits, it brings wholesome exercise; to the man tied to an office, air and exercise; to the clerk and factory hand, or others, whose lives are monotonous and machine-like, it gives occasion for intellectual effort; and, in inciting to thought and study, makes them feel more truly that they are men. To our sisters, it offers all the above attractions, and, more, may serve to drive the wolf from the door. To all of us, who become successful apiarists, it spreads an intellectual feast that the old philosophers would have envied, furnishes the rarest food for the observing faculties, and brings us into that intimate communion with nature which is never-failing in its tendency to refine the tastes, elevate the feelings, and ennoble manhood.

WHAT SUCCESSFUL BEE-KEEPING REQUIRES.

No one should commence this business who is not willing to read, think, and study. To be sure, the unthinking may stumble on success for a time, but sooner or later failure will set her seal upon his efforts. Those of our apiarists who have studied the hardest, observed the closest, and thought the deepest, have even passed the late terrible winters with but slight loss.

Prompt attention to the needs of his industrious little servants, is another absolute requirement. To be sure, this attention is slight, and so is apt to be neglected; but always with loss,—often with disaster. That "bees work for nothing and board themselves" is only comparatively true. Their demands are indeed light; but they *must be* met.

Enthusiasm, or real love for the business, is another requisite. This is a plant whose growth, with the least opportunity, is sure. It only demands per-

sistence. The beginner, without either experience or knowledge, may meet with discouragements,—undoubtedly will. Swarms will be lost, others will fail to winter, the young apiarist will become nervous,—which will disgust the bees in so much that they will essay to administer reproof of a sharp and pointed kind. Yet, with *persistence* all of these difficulties will fade away. Every contingency will be foreseen and provided against, and the myriad little workers will become as manageable and may be fondled as safely as a pet dog or cat. And the apiarist will minister to their needs with the same fearlessness and self-possession that he would attend to his gentlest cow or favorite horse. Persistence in the face of those discouragements, which are so apt to confront inexperience, will surely triumph. For he who has one jot of appreciation of the beautiful and the marvelous in his character will soon grow to love his insect pets, and the labor attendant upon their care and management, and this love will soon kindle into enthusiasm.

CHAPTER II.

THE BEE'S PLACE IN THE ANIMAL KINGDOM.

THE BRANCH OF THE HONEY-BEE.

The Honey-bee belongs to the great branch of animals known as Articulates, a very appropriate name given by the great French naturalist Cuvier, as it refers to the ring or jointed structure which characterizes all the animals of the group, whether worms, crustacea—which includes the lobsters, sow-bugs, and barnacles—or true insects. These rings form a skeleton, which, unlike that of the higher vertebrate branch, is external, and this serves to protect the softer inner parts, as well as to give strength and solidity. An examination of a bee will quickly reveal these rings, while in our beautiful Italians coloration makes them show even more plainly.

CLASS OF THE HONEY-BEE.

Our subject belongs to the class Insecta, which is characterized by breathing air usually through a very complicated system of air tubes. These tubes are very peculiar in their structure, as they are formed of a spiral thread, and thus resemble a hollow cylinder which might be formed by closely winding a fine wire about the finger, and then withdrawing the latter, the wire remaining unmoved. These tubes are constantly branching and are almost infinite in number. Nothing is more surprising and interesting than this labyrinth of beautiful tubes as seen in dissecting a bee under the microscope. I have frequently detected myself taking long pauses in making dissections of the honey-bee, as my attention would be fixed in admiration of this beautiful breathing apparatus. Doubtless all of my readers have associated the quick movements and surprising activity of birds and most mammals with their well developed lungs. So, too, in such animals as the bee we see the relation between this intricate system of air-tubes—their lungs—and the quick, busy life which has been proverbial of them since the earliest times.

ORDER OF THE HONEY-BEE.

Our bees belong to the order Hexapods, or true Insects. The first term is appropriate, as all have in the imago or last stage, six legs. Nor is the second

term less applicable, as the word insect comes from the Latin and means to cut in, and in no other articulates does the ring structure appear so marked upon merely a superficial examination. More than this, the true insects when fully developed, have unlike all other articulates, three well marked divisions of the body, namely: the head, which contains the antennæ—the horn-like appendages common to all insects; eyes and mouth organs; the thorax, which bears the legs, and wings, when they are present; and lastly, the abdomen, which, though usually memberless, contains the ovipositor, and when present, the sting. Insects, too, undergo a more striking metamorphosis than do most animals. When first hatched they are worm-like and called larvæ, which means masked; afterward they are frequently quiescent, and would hardly be supposed to be animals at all. They are then known as pupæ. At last there comes forth the imago with compound eyes, antennæ, and wings. In some insects the transformations are said to be incomplete, that is the larva, pupa, and imago differ little except in size, and that the latter possesses wings.

SUB-ORDER OF THE HONEY BEE.

The honey bee belongs to the sub-order Hymenoptera, which also includes the wasps, ants, ichneumon-flies and saw-flies. This group contains insects which possess a tongue by which they may suck (see Fig. 12 *a*), and strong jaws (see Fig. 12 *c*) for biting. Thus the bees can sip the honeyed sweets of flowers, and also gnaw away mutilated comb. They have, besides, four wings, and undergo complete transformations.

FAMILY OF THE HONEY BEE.

The honey bee belongs to the family Apidæ. Insects of this family have robust bodies, usually very hairy, large heads, prominent eyes,—which in the males meet above,—elbowed antennæ, and very long tongues. Many of these are social, and besides the true females, every colony possesses those with abortive ovaries, which are called neuters or workers. This group includes the wax-secreting bees, and the humble-bees, which do not build wax cells, but simply lay their eggs in the pollen masses, and the larvæ, by feeding on the pollen, hollow out egg-shaped cavities, which become the honey cells. Thus *some* larvæ feed only on pollen. Others of this family are solitary, like the carpenter bee, which bores in wood; the sand-bee, which digs in the earth; and the tailor bee, which cuts those regular pieces, circular or oblong, from our rose-leaves or rose-petals, and from which it forms its wonderful thimble-shaped cells. Thus we see that all the insects of this family possess strange instincts, and habits so curious that few subjects of study yield more real pleasure and gratification.

GENUS OF THE HONEY-BEE.

The genus Apis is characterized by the peculiar structure of the mouth-parts and the venation of the wings. But to particularize would lead me too deeply into the details of structure.

SPECIES OF THE HONEY-BEE.

The scientific name of the honey-bee is Apis mellifica, and the species will be fully described as we proceed to explain its natural history and habits. The races of the honey-bee will also be more appropriately considered in the sequel.

CHAPTER III.

NATURAL HISTORY OF THE HONEY-BEE.

Close examination of any prosperous colony of bees, in the summer season, will discover a marked difference in the individuals composing it. A large majority will appear small, a few hundred large and heavy, while a single one will fix attention by her long, tapering abdomen. Thus we have the workers, drones, and queen: the first being undeveloped females, called neuters; the second, males; and the last the fully developed female. Let us examine these in detail.

THE NEUTERS, OR WORKER-BEES.

These (see Fig. 1) are by far the most numerous individuals of the hive, there being from 20,000 to 40,000 in every good colony. They are also the smallest members of the colony, measuring but little more than one-half inch in length, and being only two-thirds the length of the queen. They also possess peculiarities of structure which at once distinguish them from both the queen and drones. Their tongues (see Fig. 12) are almost twice as long as in either the drone or queen; their jaws are much stronger; their wings, like the wings of the drone, attain the extremity of the body, while the tibia and tarsi—names given to the last joints of the legs—of the posterior legs are hollowed out,

FIG. 1.

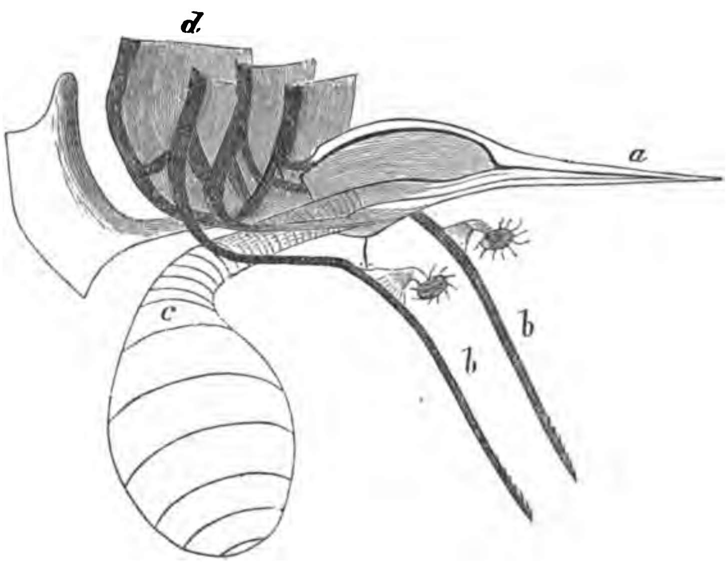

FIG. 2.

forming pollen-baskets, in which respect they differ from both the drones and the queen; the eyes do not differ from the same in the queen, but are smaller than those of the drone, and do not meet above.

The workers also possess a natural weapon of defense, the sting (see Fig. 2), which they are free to use as occasion requires. The mechanism of this organ is very interesting. At its base is a double gland, which secretes the poison; which, when secreted, is poured into an ample poison sack (Fig. 2, *c*), which is as large as a flax seed. The sting proper is a triple organ, consisting of three sharp spears, very smooth and of exquisite polish, which lie side by side, and make up the sting as seen by the naked eye. The central lance (Fig. 2, *a*) is hollow,—a little shorter than the others. The central opening connects with the poison sack, so that the poison all passes through this part of the sting. The side pieces (Fig. 2, *b b*) are marvelously sharp, and each barbed at the end with teeth, of which seven are prominent, and which extend out and back like the barb of a fish-hook, so that the sting cannot be withdrawn when once fairly used, and with its loss the bee's life is sacrificed. These side pieces are worked alternately by small muscles (Fig. 2, *d*) at the base of the sting, and when fairly inserted the poison is intruded through the central piece. The workers also possess a honey stomach (Fig. 3), or crop, in which the honey is carried to the hive.

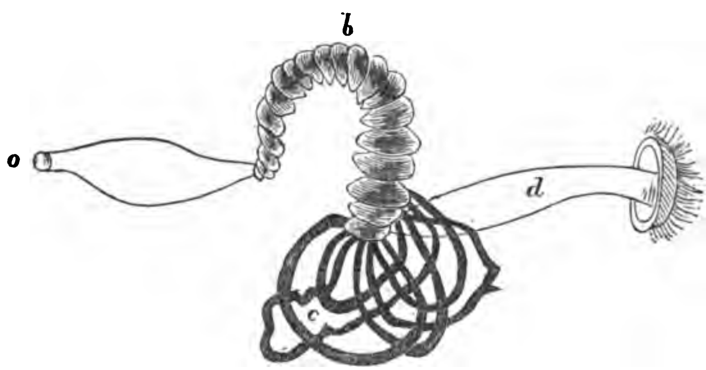

FIG. 3.
Alimentary Canal.—*a*, honey stomach; *b*, true stomach; *c*, urinary tubes; *d*, intestine.

The workers always hatch from an impregnated egg, which can only come from a fertile queen, and is always laid in the small horizontal cells (see description of comb and Fig. 11). The eggs are in the form of a short, slightly-curved cylinder, and are fastened by one end to the bottom of the cell. They can be easily seen by holding the comb so that the light will shine into the cells. The eggs hatch in about four days. The larva (Fig. 4) is white and footless, and lies coiled up, floating in the whitish fluid previously placed in the cell. This food is composed of pollen and honey, and is all consumed by the larva. In about five days the cell is capped over by the bees. The cap is composed of pollen and wax, so that it is darker, more porous, and more easily broken than the honey caps. It is also more convex. The larva, now full grown, commences to surround itself with a thin cocoon made of fine silk, and in three days assumes the pupa state (Fig. 5), when it is called a nymph. It now looks like the imago or fully developed bee, except that the legs, wings, and tongue are folded on the breast, and the insect is now colorless. Upon the twenty-first day the bee emerges from the cell.

FIG. 4.

FIG. 5.

The worker bees never attain a great age. Those reared in autumn may live for nine months, while those bred in spring will wear out in three. None of the worker bees survive the year through. So there is a limit to the number which may exist in a colony. Their longevity depends upon their activity, and hence upon the time of year in which they live.

The function of the worker bees is to do all the manual labor of the hive. They secrete the wax, which forms in small pellets beneath the abdomen, build the comb, feed the young bees, or, rather, the larvæ, and cap the cells, whether they be brood or honey cells. Thus far the work is done by the younger bees. The older bees gather the honey, collect the pollen, or bee-bread, as it is generally called, bring in the propolis, or bee-glue, which is used to close up openings, and as a cement, supply the hive with water, defend the hive from all improper intrusion, destroy drones when their day of grace is past, kill and arrange for replacing worthless queens, and lead forth a portion of the bees when the conditions impel them to swarm.

THE DRONES.


FIG. 6.

The male bees (Fig. 6) are only found in the hive from May till November, when there will be a few hundred, though the number may be controlled by the Apiarist, and should be greatly reduced. These are longer than the workers, being nearly ¾ of an inch in length and more bulky than either the queen or neuters. Their flight is heavy, and they may be known by their deep, low hum. Their tongue is short, jaws weak, and their posterior members destitute of pollen baskets. The eyes meet above, and are very prominent. The drones, too, have no defense organ, the sting being absent.

The male bees come from unimpregnated eggs, a fact which, though it almost staggers credulity, is easily proved, and beyond question. These eggs may come from an unimpregnated queen, a fertile worker,—for very rarely a worker bee will deposit eggs, such bees doubtless meeting in part the conditions which we shall see in the sequel produce queens,—or from an impregnated queen, which may voluntarily prevent impregnation. Such eggs are placed in the larger horizontal cells (Fig. 11) in the same manner as the worker eggs are placed in the smaller cells. The capping of the drone cells is very convex, and protrudes beyond the general level of the comb, so that drone brood is very easily distinguished from worker, and, from the darker color of the capping, both drone and worker brood are very readily distinguished from honey. The development of the drones from egg to larva, to pupa, and to imago, is essentially like that of the workers, though they do not come forth till the twenty-fourth day from the laying of the egg. Of course difference of temperature and other conditions may slightly advance or retard the development of any brood in the different stages. The drones,—in fact all bees,—when they first emerge from the cells, are gray, soft, and appear unsophisticated generally.

Just what the longevity of the male bee is I am unable to state. They appear in May and are destroyed in October and November. It is not improbable that some may live during the entire time.

The function of the drones is solely to impregnate the queens. This is done on the wing, outside the hive, usually during the heat of warm, sunshiny days. After mating, the drone organs adhere to the queen, and their abstraction is fatal to the life of the drone. As a queen never meets but a single drone, and

that only once, it might be asked why nature was so improvident as to decree hundreds of drones to an apiary or colony, whereas a score would suffice as well. Yet nature takes cognizance of the importance of the queen, and as she goes forth amidst the myriad dangers of the outer world, it is safest and best that her stay abroad be not protracted; hence the superabundance of drones, —especially under natural conditions, isolated in forest homes, where ravenous birds are ever on the alert for insect game,—is most wise and provident. Artificial circumstances require no such conditions, nor are they then enforced.

THE QUEEN.

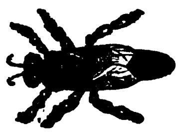

Fig. 7.

The queen (Fig. 7) is the true mother bee, or in other words a perfectly developed female, with large, full-formed ovaries, which occupy the larger part of her abdomen. These organs (Fig. 8), one on either side of the back, are multitubular, each consisting of many tubes (Fig. 8, *a a*), in which grow the eggs, for the eggs of all animals are a growth, not a secretion. From each ovary leads a special duct (*b*, Fig. 8), which ducts finally unite into the common oviduct (*c*, Fig. 8), through which all the eggs pass. By the

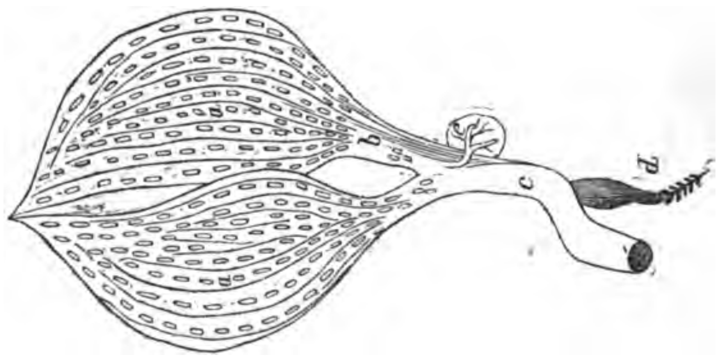

Fig. 8.

side of this oviduct is a little pea-shaped sock (*e*, Fig. 8), called the spermatheca, which, during copulation or mating, is filled with the seminal or male fluid. About this sock are voluntary muscles, so that the queen can bring the fluid, if she desires, in contact with the eggs as they pass. This, of course, is the most important structural peculiarity of the queen, as this makes her a female, but she has other differences worthy of mention: she is longer than either drone or worker, being over seven-eighths of an inch long, and with her long, tapering abdomen is not without real grace and beauty. The queen's tongue (Fig. 9) is short, her jaws weak, eyes like the neuter's, wings short, hardly more than half the length of the abdomen. She has no pollen-baskets, but possesses a sting which resembles that of the humble-bee, in being curved (see *d*, Fig. 8), yet, strange as it may appear, she can seldom be induced to make use of it. I have often tried to provoke a queen's anger, but never with any evidence of success.

The queen, like the neuters, is developed from an impregnated egg, which of course could only come from a fertile queen. These eggs are not placed in a horizontal cell, but in one specially prepared for their reception. These queen cells (Fig. 11) are usually built on the edge of, or around an opening in the

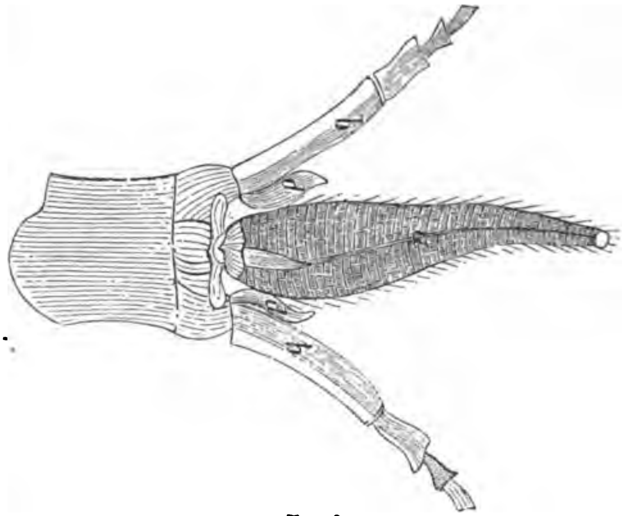

FIG. 9.
a, tongue, or ligula; *b*, labial palpi; *d*, paraglossæ.

comb, extend either vertically or diagonally downward, and much resemble a thimble or a pea-nut in form and size. The eggs are placed in these cells, either by the worker bees, which transfer them from worker cells, or else by the queen. Some apiarists doubt that the queen ever places an egg in a queen cell, but I have no doubt of the fact, though I never witnessed the act. I have frequently seen the eggs in these cells in exactly the position which the queen always places her eggs. Nor have I much respect for the arguments which are built on an inferred discord between the queen and neuters. I believe there is a better understanding between the inmates of the hive than is generally believed by apiarists. It is probably true that the actions of the bees are influenced and controlled by circumstances or conditions, but I have yet to see satisfactory proof that these conditions differently impress the queen and workers. The conditions which usually lead to the building of queen cells and the peopling of the same, are loss of queen, inability of queen to lay fertile eggs, and too great numbers of bees, or too little room in the hive, which is likely to be true in times of great honey secretion. The queen may be developed from an egg or from a worker larva less than three days old, which will then be transferred from a worker to a queen cell. The development of the queen is much the same as that of a worker, though she is fed richer and more plenteous food, called royal jelly. So abundant is this royal pabulum that there is always some remaining in the cell after the queen issues. It is probable that the more profuse and sumptuous diet, perhaps aided by a more ample habitation, is what accelerates and perfects the development of her royal highness. Yet the fact of fertile workers, and the easy probability of their having received a little richer and more plenteous diet than their sisters, would lead us to suppose that the food, both as to quality and quantity, is what had most influence. The cocoon surrounding the queen nymph or pupa is imperfect next the outer end of the cell. It has been supposed by some that this was an act of thoughtfulness on the part of the queen larva, thus to render her own destruction more easy, should the welfare of the colony demand it. In sixteen days from the laying of the egg, or from

ten to twelve days from the starting of a queen from the worker larva the queen issues from her cell. As the queen's development is probably mainly due to superior character and quality of food, it would stand to reason that queens from the eggs are preferable; and under normal circumstances I believe the bees in nature thus start them nearly always. The best experience sustains this conclusion. As the proper food and temperature could best be secured in a full colony—and here again the natural economy of the hive adds to our argument—we should infer that the best queens would come from strong colonies. Experience also confirms this view.

Five days after issuing from the cell, if the day is pleasant, the queen goes forth on her "marriage flight," otherwise she will improve the first pleasant day for this purpose. If she fails to find an admirer the first day, she will go forth again and again till she succeeds. If the queen is observed upon her return from the wedding tour, it may be easily determined whether or no she has been successful, for if she has she will bear suspended to her body the organs of the drone. If the queen lays any eggs before meeting the drone, or if for any cause she fails to meet the drone, the eggs will of course only produce drone bees. About two days after fertilization takes place the queen commences under normal circumstances to lay worker eggs, and the first year lays few others.

The queen, when considered in relation to the other inhabitants of the colony, possesses a surprising longevity. It is not uncommon for her to attain the age of three years in the full possession of her powers, while queens have been known to live even five years. Queens, often at the expiration of one, two, three, or four years, depending upon their vigor and excellence, either cease to be fertile or else become impotent to lay any but drone eggs, the spermatheca having become emptied of the seminal fluid. In such cases the workers usually supersede the queen; that is, they destroy the old queen and start queen cells for the purpose of rearing young, fertile, and vigorous queens.

The function of the queen is simply to lay eggs, and thus keep the colony populous; and this she does with an energy that is fairly startling. A good queen in her best estate will lay two or three thousand eggs a day. Yet with even these figures as an advertisement, the queen bee can not boast of superlative fecundity, as the queen white-ant—an insect closely related to the bees in habits, though not in structure, as the white-ants are lace-wings and belong to the sub-order Neuroptera, which includes our day-flies, dragon flies, etc.—is known to lay over 80,000 eggs daily. Yet this poor helpless thing whose abdomen is the size of a man's thumb, and composed almost wholly of eggs, while the rest of her body is not larger than the same in our common ants, has no other amusement. She cannot walk, she can not even feed herself or care for her eggs. What wonder then that she should attempt big things in the way of egg-laying? She has nothing else to do or to feel proud of. Different queens vary as much in fecundity as do different breeds of fowls. Some queens are so prolific that they fairly demand hives of india rubber to accommodate them, keeping their hives fairly gushing with bees and profitable activity, while others are so inferior that the colonies make a poor sickly effort to survive at all, and usually succumb early, before those adverse circumstances which are ever waiting to confront all life on the globe.

The old poetical notion that the queen is the revered and admired sovereign of the colony, whose pathway is ever lined by obsequious courtiers, whose person is ever the recipient of loving caresses, and whose will is law in this bee-hive

kingdom, controlling all the activities inside the hive, and leading the colony whithersoever they may go, is unquestionably mere fiction. In the hive, as in the world, individuals are valued for what they are worth. The queen, as the most important individual, is regarded with solicitude, and her removal or loss noted with consternation, as the welfare of the colony is threatened; yet, let the queen become useless, and she is despatched with the same absence of emotion that characterizes the destruction of the drones when they have become supernumeraries. It is very doubtful if emotion or sentimentality are ever moving forces among the lower animals. There are probably certain natural principles that govern in the economy of the hive, and aught that conspires against, or tends to intercept the action of these principles, becomes an enemy to the bees. All are interested, and doubtless more united than is generally believed, in a desire to promote the free action of these principles. No doubt the principle of antagonism among the various bees has been overrated. Even the drones when they are being killed off in the autumn make a sickly show of defense, as much as to say, the welfare of the colony demands that such worthless vagrants should be exterminated; "so mote it be, go ahead." The statement, too, that there is often serious antagonism between the queen and workers, as to the destruction or preservation of inchoate queens, yet in the cell, is a matter which may well be investigated. It is most probable that what tends most for the prosperity of the colony is well understood by all, and without doubt there is harmonious action among all the denizens of the hive, to foster that which will advance the general welfare, or to make war on whatever may tend to interfere with it. If the course of any of the bees seems wavering and inconsistent, we may rest assured that circumstances have changed, and that could we perceive the bearing of all the surrounding conditions, all would appear consistent and harmonious.

CHAPTER IV.

SWARMING, OR NATURAL METHOD OF INCREASE.

The natural method by which an increase of colonies among bees is secured is of great interest, and though it has been closely observed and accurately studied for a long period, and has given rise to theories which were as often absurd as sound, yet, even now, it is a fertile field for investigation, and will surely repay any who may come with the true spirit of inquiry, for there is much concerning it which is involved in mystery. Why do bees swarm at unseemly times? Why is the swarming spirit so excessive at times and so restrained at other seasons? These and other questions we are too apt to refer to erratic tendencies of the bees, when there is no question but that they follow naturally upon certain conditions perhaps intricate and obscure, which it is the province of the investigator to discover. Who shall be first to unfold the principles which govern in these as in all other actions of the bees?

In the spring or early summer, when the hive has become populous and storing very active, the queen, as if conscious that a home could be overcrowded, and forseeing such danger, commences to deposit drone eggs in drone cells,

which the worker bees, perhaps moved by like considerations, begin to construct, if they are not already in existence. In fact, drone comb is almost sure of construction at such times. No sooner is the drone brood well under way than the large awkward queen-cells are commenced, often to the number of ten or fifteen, though there may be not more than three or four. In these eggs are placed, and the rich royal jelly added, and soon, often before the cells are even capped, some bright day, usually about ten o'clock, after an unusual disquiet both inside and outside the hive, a large part of the worker-bees, having previously loaded their honey-sacks, rush forth from the hive as if alarmed by the cry of fire, the queen among the number, though she is by no means among the first, and frequently is quite late in her exit. The bees thus started on their quest for a new home, after many uproarious gyrations about the old one, dart forth to alight upon some bush, limb, or fence, though in one case I have known the first swarm of bees to leave at once for parts unknown without even waiting to cluster. After thus meditating for the space of from one to three hours upon a future course, they again take wing and leave for their new home, which they have probably already sought out. If for any reason the queen should fail to join the bees, and perhaps rarely, when she is among them, they will, after having clustered, return to their old home. The youngest bees will remain in the old hive, to which those bees which are abroad in quest of stores will return. The presence of young bees on the ground,—those with flight too feeble to join the rovers,—will always mark the previous home of the emigrants. Soon, in about eight days, the first queen will come forth from her cell, and in two or three days she will or may lead a new colony forth, but before she does this the peculiar note, known as the piping of the queen, may be heard. At successive periods of one or two days one, two, or even three more colonies may issue from the old home. These last swarms will all be heralded by the piping of the queen. They will be less particular as to the time of day when they issue, and as a rule will cluster farther from the old hive.

The cutting short of swarming preparations before the second, third, or even the first swarm issues is by no means a rare occurrence. This is done by the bees destroying the queen cells, and sometimes by a general extermination of the drones, and is generally to be explained by a cessation in the honey yield.

CHAPTER V.

THE PRODUCTS OF THE HIVE, WHERE AND HOW OBTAINED, AND FOR WHAT PURPOSE.

HONEY.

Of course the first product of bees, not only to attract attention, but also in importance, is honey. And what is honey? We can only say that it is a sweet substance gathered from flowers and other sources by the bees. We cannot, therefore, give its chemical composition, which would be as varied as the sources from which it comes. We cannot even call it a sugar, for it may be, and always is composed of various sugars, and thus it is easy to understand why

honey varies so much in richness, color, flavor, and effects in digestion. In fact, it is very doubtful if honey is a manufactured article at all. It seems most likely that the bees only collect it as it is distilled by myriad leaves and flowers, and store it up that it may minister to their and our necessities. To be sure, some writers contend that it undergoes some change while in the bee's stomach; but the rapidity with which they store, and the seeming entire similarity between honey and sugar fed to them, and the same immediately extracted from the comb has led me to believe that the transforming power of the stomach is very slight, if indeed it exists at all. The method of collecting the honey is for the bee to insert her long tongue into the flower till it reaches the honey, which, by suction, is drawn into the sucking stomach. When the stomach is full the bee repairs to the hive and regurgitates its precious load, storing it in the cells. When there are no flowers, or when the flowers yield no sweets, the bees, ever desirous to add to their stores, frequently essay to rob other colonies, and often visit the refuse of cider mills, or suck up the oozing sweets of various plant or bark lice, thus adding, may be, unwholesome food to their usually delicious and refined stores. It is a curious fact that the queen never lays her maximum number of eggs except when storing is going on. In fact, in the interims of honey-gathering, egg-laying not infrequently ceases altogether. The queen seems discreet, gauging the size of her family to the probable means of support.

Again, in times of extraordinary yields of honey, the storing is so rapid that the hive becomes filled, thus depriving the queen of opportunity to lay eggs, and of necessity depleting the colony. This might be called ruinous prosperity.

The natural use of the honey is to furnish the mature bees with food, and when mixed with pollen to form the diet of the young bees.

WAX.

The product of the bees second in importance is wax. As already remarked, this is a secretion, formed in pellets (Fig. 10, *a a*, etc.) underneath the abdomen. This wax is mixed with a sort of saliva in the bee's mouth, and after the proper kneading, is formed into that wonderful and exquisite structure, the comb. Honey-comb (Fig. 11), so wonderfully delicate, and so formed as to combine the greatest strength with the least expense of material, has been a subject of admiration since the earliest time. The character of the cells, whether drone or worker, seems to be determined by the relative abundance of bees and honey. If the bees are abundant and honey needed, or if there is no queen to lay eggs, drone comb (Fig. 11, below to the left), is invariably built, while if there are few bees, and of course little honey needed, then worker comb (Fig. 11, above and to right), is almost as invariably formed.

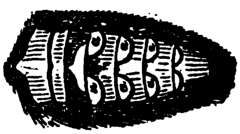

FIG. 10.

All comb when first formed is clear and transparent. The fact that it is often dark and opaque implies that it has been long used as brood-comb, and the opacity is due to the innumerable thin cocoons which line the cells. Such comb need not be discarded, for if composed of worker-cells, it is still very valuable for breeding purposes, and should not be destroyed till the cells are *too* small for longer service, which will not occur till after many years of use.

The function then of the wax is to make comb and caps for the honey cells, and, combined with pollen, to form queen cells (Fig. 11, 1, 2, 3, 4, and 5) and caps for the brood cells.

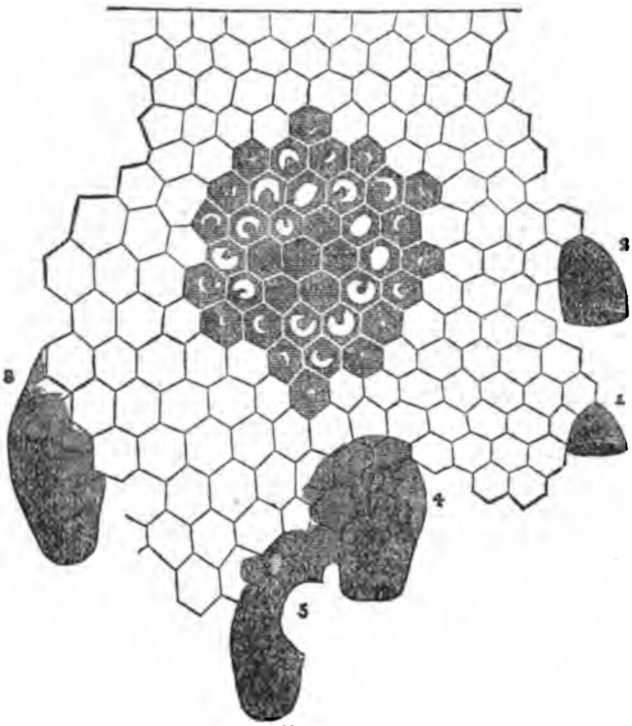

FIG. 11.

The comb furnishes cells for the storage of honey, and in which to rear brood.

POLLEN OR BEE-BREAD.

This substance, like honey, is not secreted, nor manufactured by the bees, only collected. The bees usually obtain it from the stamens of flowers. But if they gain access to flour when there is no bloom, they will take this in lieu of pollen, in which case the former term used above becomes a misnomer, though usually the bee-bread consists almost wholly of pollen.

As already intimated, the pollen is conveyed in the pollen baskets of the posterior legs, to which it is conveyed by the other legs, and compressed into little oval masses. The motions in this conveyance are exceedingly rapid. The bees not infrequently come to the hives, not only with replete pollen baskets, but with their whole under surface thoroughly dusted. Dissection will also show that the same bee may have her sucking stomach distended with honey. Thus the bees make the most of their opportunities. It is a curious fact that the bees, during any trip, gather only a single kind of pollen, or only gather from one species of bloom. Hence, while different bees may have different colors of pollen, the pellets of bee-bread on any single bee will be uniform in color throughout. It is possible that the material is more easily collected and compacted when homogeneous.

The pollen is usually deposited in the small or worker cells, and is unloaded by a scraping motion of the posterior legs, the pollen baskets being first lowered into the cells. The bee thus freed leaves the wheat-like masses thus deposited to be packed by other bees. The cells, which may or may not have the same

color of pollen throughout, are never filled quite to the top, and not infrequently the same cell may contain both pollen and honey. Such a condition is easily ascertained by holding the comb between the eye and sun. If there is no pollen it will be wholly translucent; otherwise there will be opaque patches. A little experience will make this determination easy, even if the comb is old. It is often stated that queenless colonies gather no pollen, but this is not true, though very likely they gather less than they otherwise would. It is probable that pollen, at least when honey is added, contains all the essential elements of animal food. It certainly contains the very important principle, which is not found in honey: nitrogenous material.

The function of bee-bread is to help furnish the brood with proper food. In fact, brood-rearing would be impossible without it. And though it is certainly not essential in the nourishment of the bees themselves, it still may be so in time of wax secretion.

PROPOLIS.

This substance, also called bee-glue, is collected, not made nor secreted. It is the product of various resinous buds, and may be seen to glisten on the opening buds of the hickory and horse-chestnut, where it frequently serves the entomologist by capturing small insects. From such sources, from the oozing gum of various trees, from varnished furniture, and from remaining propolis about unused hives, that have previously seen service, do the bees secure their glue. This substance has great adhesive force, and though soft and pliable when warm, it becomes very hard and unyielding when cold.

The use of this substance is to cement, to fill up all rough places inside the hive, to seal up all crevices except the place of exit, and even to cover any foreign substance that cannot be removed. Intruding snails have thus been imprisoned inside the hive.

CHAPTER VI.

THE RACES OF BEES.

There are three races or breeds of the species Apis mellifica, viz.: The Egyptian, German or black, and the Italian or Ligurian.

As the Egyptian bee is not kept either in Europe or our own country, and as I have no authentic description of its habits or character, I will only dwell on the other races.

GERMAN BEES.

These are the common bees of Europe, and were those first imported to our country, and so became common here. The queen and drones are of a deep black hue, while the neuters are more obscure, though still black, with a very slight grayish cast. As these are so well known, I will not stop to consider their habits, but wait and contrast them in this respect with the Italians.

ITALIAN BEES.

These bees take their name from the fact that they were first discovered in the mountain basin of northern Italy and Switzerland, shut in, as it were, by

the Alps. Without much doubt they are a climatic variety, with characters of coloration and habits so inbred that they are a fixed race. It may be, as has been asserted, that the original stock was a cross between the black and the Egyptian races. The queen varies much in color. She may be almost entirely yellow, is rarely almost as black as the German queen, but is generally irregularly marked with black and yellow. The drones are also black, annulated, or spotted with yellow, while the neuters will without exception, if the stock is pure, possess three yellow bands about the base of the abdomen. I repeat, every bee in the colony must be thus marked. The first ring is close to the thorax, and very narrow. The second is quite broad. These two rings are usually quite distinct in hybrids. The third ring is narrower, and may be obscured in old bees, especially if not distended with honey. When this ring is absent in any of the bees there is "something rotten in Denmark."

The able agricultural editor of one of our leading State papers has unwisely invaded the apiary in one or two editorials; and, wise beyond what is written, has stated that the Italians were in no wise superior to the black bees; and, further, that this point was conceded by all disinterested apiarists. He might as well say that a Duchess among Short-horns was in no wise superior to the lean, bony kine of Texas; or that our Essex and Berkshire swine are no whit better than the cadaverous lank breeds, with infinite noses, that happily are now so rare among us. The Italians are *far* superior to the German bees in many respects, and more,—though I am acquainted with all the works on apiculture printed in our language, and have an extensive acquaintance with the leading apiarists of our country from Maine to California, yet I know of only one man who holds that the Italians are no better than the Germans, and he is proverbial for opposing any and every thing which any other person may present. I have yet to conceive how so able, careful, and conscientious a writer could have been so misled as to make so glaring and mischievous an error.

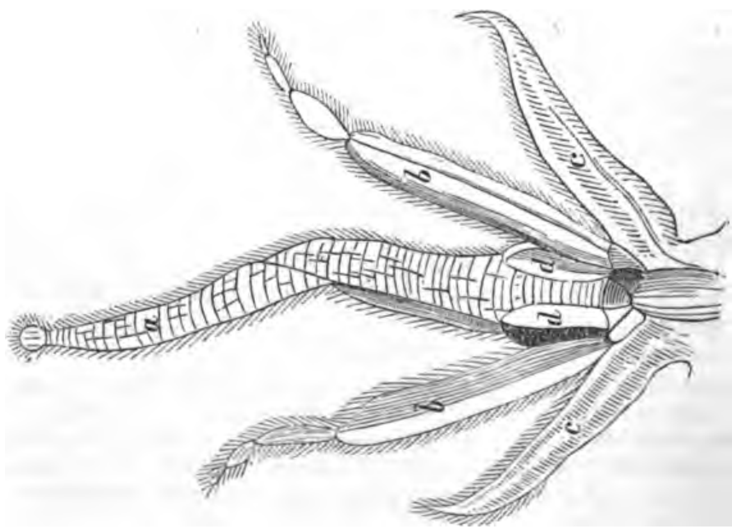

FIG. 12.

Italian worker's mouth parts; *a*, tongue; *b*, labial palpi; *c*, mandibles; *d*, paraglossæ. A black worker bee's tongue compared with this would reach only to *a* by accurate measurement.

The Italians certainly possess the following points of superiority:

First, They possess longer tongues (Fig. 12), and so can gather from flowers which are useless to the black bee.

Second, They are more active, and with the same opportunities will collect a good deal more honey.

Third, They work earlier and later.

Fourth, They are far better to protect their hives against robbers. Robbers that attempt to plunder Italians of their hard-earned stores soon find that they have "dared to beard the lion in his den."

Fifth, They are almost proof against the ravages of the bee-moth's larvæ.

Sixth, The queens are decidedly more prolific. This is probably in part due to the greater and more constant activity of the neuters.

Seventh, Brood-rearing commences earlier in the season.

Eighth, The queen is more readily found, which is a great advantage.

Ninth, The bees are more disposed to adhere to the comb while being handled, which some might hold as a doubtful compliment, but which I consider a desirable quality.

Tenth, They are far less apt to attempt to rob other hives.

Eleventh, And in my estimation, a sufficient ground for preference, did it stand alone, the bees are *far more* amiable. Years ago I got rid of my black bees, because they were so cross. This year I got two or three colonies, that my students might see the difference, but to my regret; for, come to remove the honey this autumn, they seemed perfectly furious, like demons, seeking whom they might devour, and this, too, despite the smoker, while the far more numerous Italians were safely handled, even without smoke. The experiment at least satisfied a large class of students as to superiority. No, I have kept these two races side by side for years, I have studied them most carefully, and I know that none of the above eleven points of excellence are too strongly stated.

The black bees are superior in one, and in perhaps two respects. They certainly will go into boxes more readily, to make box-honey, and I have some reason to think that they are more hardy, yet many claim that the Italians are superior in point of hardiness.

CHAPTER VII.

WHAT CONDITIONS ARE REQUISITE TO ENSURE THE GREATEST ACCOMPLISHMENTS IN THE APIARY.

The most important demand, in fact, it is the very key to all success, is, that the bees be kept strong. This fortifies against robbers, is an impregnable wall of defense against the bee-moth, helps to make the apiarist merry despite the disastrous winters, and insures a yield of precious nectar, which makes glad the heart, and full the pocket.

This demands, of course, that if swarming be allowed at all, such swarms should be secured, and that excessive swarming be prevented. It also demands that the queen should never cease laying for want of room, or empty cells in

which to deposit. That the workers should not have too long intervals of idleness, even though flowers are wanting or fail to yield honey, for as we have seen idleness of the queen follows, and of course depletion of worker bees. That colonies should never be queenless, or at least that such a condition should be very rare, and very brief; that colonies should be increased so as to involve the least loss, and least disturbance; that storing should never cease for want of room in which to store; that indolence should never be necessitated from a too high temperature inside the hive; that the bees should be in a locality where honey plants are abundant; that the bees should be so wintered as not to dwindle; that foul-brood should be known and prevented; that only the best bees should be kept; and, last, but perhaps most important of all, that the hives, though cheap and simple, should be so constructed as to secure honey in the most desirable condition, and admit the most free and easy access to the bees, so that the apiarist may know the exact condition of all his colonies at all times, and be able to administer timely aids whenever circumstances shall require it.

TO SECURE NATURAL SWARMS.

To prevent anxiety and constant watching, and to secure a more equable division of bees, and as I know more honey, it is better to provide against natural swarming entirely by use of means which will appear in the sequel. But as this requires some experience, and as often through neglect, either necessary or culpable, swarms may issue, every apiarist should be ever ready with both means and knowledge for immediate action. The means are good hives in readiness, a good jack-knife, some kind of a brush—a turkey wing will do—and a bag or basket, with ever open top, which should be at least eighteen inches in diameter, and this receptacle so made that it may be attached to the end of a pole. Two such poles, one very long, and the other shorter, and either a sheet, or light thin board platform, three by five feet, planed and strengthened by cross strips.

Now let us attend to the method: As soon as the cluster commences to form, place the sheet or platform on the ground near by, with the hive upon it, near one end. The side of the hive facing the vacant space, of either platform or sheet, should be raised a half inch, by inserting two blocks underneath, so the bees can have a good chance to enter. As soon as the bees are fully clustered, we must manage as best we can to empty the whole cluster in front of the hive. As the bees are full of honey we need have little fear of stings. Should the bees be on a twig that could be sacrificed, this might be easily cut off with either the knife or saw, and so carefully as hardly to disturb the bees; then carry and shake the bees in front of the hive, when with joyful hum they will at once proceed to enter. If the twig must not be cut, shake them all into the basket, and empty before the hive. Should they be on a tree trunk, or a fence, then brush them with the wing into the basket, and proceed as before. If they are high up on a tree, take the pole and basket, and perhaps a ladder will also be necessary.

Always let ingenuity have its most perfect work, not forgetting that the object to be gained is to get just as many of the bees as is possible on the platform in front of the hive. Carelessness as to the quantity might involve the loss of the queen, which would be serious. The bees *will not* remain unless the queen enters the hive. Should a cluster form where it is impossible to brush or shake them off, they can be driven into a basket, or hive, by holding it above them

and blowing smoke among them. As soon as they are nearly all in—a few may be flying around, but if the queen is in the new hive they will go back to their old home—remove the hive to its permanent stand. All washes are useless, it is better that the hive be clean and pure. In such, if they are shaded, bees will scarcely ever leave. But assurance will be made doubly sure by giving them a frame of brood, in all stages of growth, from the old hive. This may be inserted before the work of hiving is commenced.

HOW TO PREVENT SECOND SWARMS.

In the sequel it will appear that the wise apiarist will always have on hand extra queens. Now, if he does not desire to form nuclei (in manner to be explained), and thus use these queen cells, he will at once cut them *all* out, and destroy them, and give the old colony a fertile queen. The method of introduction will be given hereafter, though in such cases there is very little danger of giving them a queen at once. And by thoroughly smoking the bees, and sprinkling with sweetened water, and daubing the new queen with honey, we may be almost sure of success. If desired, the queen cells can be used in forming nuclei, in manner to be hereafter described. In this way we save our colony from being without a fertile queen for at least thirteen days, and that, too, in the very height of the honey season, when time is money. If extra queens are wanting, we have only to look carefully through the old hive and remove all but one of the queen-cells. A little care will certainly make sure work, as, after swarming, the old hive is so thinned of bees, that only carelessness will overlook queen-cells in such a quest.

HOW TO SECURE EMPTY CELLS FOR THE QUEEN, EVEN IN TIMES OF THE GREATEST HONEY-HARVEST.

Although some of our most experienced apiarists say nay, it is nevertheless a fact, that the queen often remains idle, or extrudes her eggs only to be lost, simply because there aré no empty cells. The honey yield is so great that the workers occupy every available space, and sometimes even they become unwilling idlers simply because of necessity. Seldom a year has passed but that I have noticed some of my most prolific queens thus checked in duty. And when I have relieved such queens from this state of enforced idleness they have always showed an activity which seemed at least to betoken great warmth of gratitude. In such cases the apiarist finds an invaluable aid in the

HONEY EXTRACTOR.

No doubt that some have expected and claimed too much for this machine. It is equally true that some have blundered quite as seriously in an opposite direction. For since Mr. Langstroth gave the movable frame to the world, the apiarist has not been so deeply indebted to any inventor as to him, who gave us the principle of the Mell Extractor Herr Von Hruschka, of Germany. Even if there was no sale for extracted honey,—aye, more, even if it must be thrown away, which will never be necessary, as it may always be fed to the bees with profit, even then I would pronounce the extractor as invaluable to every bee-keeper.

WHAT STYLE TO BUY.

The machine should be as light as is consistent with strength. It is best that the can be stationary and that only a light frame be made to revolve with the

comb. It is desirable that the machine should run with gearing, not only for ease, but also to insure or allow an even motion, so that we need not throw even drone larvæ from the brood cells. The arrangement for exit of the honey should permit a speedy and perfect shut-off.

WHEN TO USE THE EXTRACTOR.

If extracted honey can be sold for twenty, or even fifteen cents, the extractor may be used profitably the summer through; otherwise use it sufficiently often that there may always be empty worker cells in the brood chamber.

It is thus required with us during the two great honey harvests,—the white-clover and bass-wood. I have always extracted the honey at such times before it was capped, in fact, as fast as the cells were filled, and never yet found it so thin that it was not agreeable and wholesome. If it granulates it can be reduced with no injury to fluid again by heating, which is best done by placing the vessel containing it in boiling or heated water. When once brought to a boiling temperature it will seldom granulate again if kept in a dark place.

Many bee-keepers will be able to create a demand for their extracted honey. Those who cannot will find it very advantageous to feed it to their bees, at times, and in the manner described in what follows.

HOW TO INSURE CONTINUOUS BREEDING.

As already stated it is only when the worker bees are storing that the queen deposits to the full extent of her capability, and that brood-rearing is at its height. In fact, when storing ceases, general indolence characterizes the hive. Hence, if we would achieve the best success, we must keep the workers active, even before, and in the interims of honey secretion by the flowers, and to do this we must feed sparingly before the advent of bloom in the spring, and whenever the neuters are forced to idleness during any part of the season, by the absence of honey-producing flowers. For a number of years I have tried experiments in this direction by feeding a portion of my colonies early in the season, and in the intervals of honey-gathering, and always with marked results in favor of the practice. The past season three of our students tried similar experiments, between the bass-wood bloom and the fall flowers, and with as striking evidence in favor of the practice. Early feeding also fills the necessary space in the brood chamber, so that at the dawn of the white clover era, the delicious nectar then gathered will, of necessity, be stored in the boxes or frames set apart for this delightful harvest.

HOW MUCH TO FEED.

In such cases the amount fed need not be great. A half pound a day, or even less, will be all that is necessary to encourage the bees to active preparation for the good time coming.

WHAT TO FEED.

For this purpose I would feed coffee A sugar, reduced to the consistency of honey, or else extracted honey kept over from the previous year. The price of the latter will decide which is most profitable. Many advise feeding the poorer grades of sugar in spring. My own experience makes me question the policy of ever using such feed for bees.

HOW TO FEED.

The feeder (Fig. 13) which I have used with the best satisfaction is much the

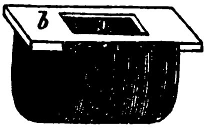

FIG. 13.

form of a frame of comb with the lower half cut off. The top bar (*b*, Fig. 13) is two inches wide and one-half inch thick, with a central hole (*c*, Fig. 13) one inch wide by three long. Tacked to the edge of this top-bar is a bag made of drilling, which should not reach nearer the ends than one inch, and should not be more than half as deep as the hive. This is put into a hive either at the end or between the frames. If at the end and a quilt is used to cover the frames the quilt need not extend over the feeder, but tuck in closely beside it, thus precluding any bees gaining entrance to the feeder. If it is placed between other frames the quilt should be stuck to the top bar of the feeder, and a hole or flap cut in it immediately above the hole in the bar. If a honey board is used, the bar of the feeder can be fastened to the honey board, with the hole immediately beneath the same in the honey board. Now, to feed we have only to raise the top of the hive, and with a tin pail with a long spout turn in our feed. As the bees can not get above they cause us no trouble. And the feeding becomes a matter of great ease and rapidity. The drilling should be just fine enough to permit the syrup to ooze through. I have even used very closely woven unbleached factory. These feeders can be washed out when not in use, and can be used for feeding whenever it is desired, for whatsoever purpose.

COLONIES SHOULD NEVER BE QUEENLESS.

Suppose the queen is laying 2,000 eggs a day, and that the full number of bees is 40,000, then it will be seen that each day that a colony is without a queen there is a loss equal to one-twentieth of the working force of the colony, and this is a compound loss, as the aggregate loss of any day is its special loss, augmented by the several losses of previous days. Now, as queens are liable to die, to become impotent, and as the act of increasing colonies demand the absence of queens, unless the apiarist has extra ones at command, it is imperative, would we secure the best results, to ever have at hand extra queens.

HOW TO REAR QUEENS.*

As queens may be needed by the last of May, preparations looking to the early rearing of queens must commence early. When preparing the colonies for winter the previous autumn, be sure to place some drone comb somewhere near the centre of the colony that has given the best results the previous season. In March, and certainly by the first of April, see that all colonies have plenty of bee-bread. If necessary, place unbolted flour, rye is best, in shallow troughs near the hives. It will be well to give the whole apiary the benefit of such feeding before the flowers yield pollen, but the colony under consideration should be given frames containing bee-bread which was stored the previous year. At the same time, March or April, commence stimulative feeding. If you have another colony equally good with the first, also give that the pollen, and commence giving it feed, but only worker comb should be in the brood chamber. Very likely in April drone eggs will be laid in the drone comb. I have had drones flying the first of May. As soon as the drones commence to hatch out remove the queen. If two equally good colonies are being fed, remove the queen from the one that is without drone comb. This queen may be used in making a new colony, in manner soon to be described under artificial swarming, or increasing the number of colonies. This queenless colony will immediately commence forming queen cells. (Fig. 11.) Sometimes these are formed to the number of fifteen or twenty, and they are started, too, in a full vigorous colony,

in fact, under the most favorable conditions. Cutting off edges of the comb, or cutting holes in the same where there are eggs or larvæ just hatched, will almost always insure the starting of queen cells in such places. There is one disadvantage in this course which would not have been true had the bees been left till they prepared to swarm: the queens are almost sure to be started from worker larvæ two or three days old, yet if left till preparation for swarming was made, the number of queen cells is apt to be very small. We could wait, at quite an expense of time, and after six days cut out all queen cells then started, and insert fresh eggs from our favorite queen, and remedy both evils. If this is deemed best, we can cut out small pieces of comb, containing eggs or larvæ just hatched, and insert in holes cut in the brood comb of the colony where we are to rear our queens. Thus we meet every possible requisite for raising the most superior queens. In fact, we exercise a care in our breeding that even the best horse or cattle breeders cannot surpass. In a week these cells are capped, and the apiarist is ready to form his

NUCLEI.

A nucleus is simply a miniature colony of bees—a hive and colony on a small scale, for the purpose of rearing and keeping queens. We want the queens, but can afford to each nucleus only a few bees. The nucleus hive, if we use frames not more than one foot square, need be nothing more than an ordinary hive, with chamber confined by a division board (see section on hives) to the capacity of three frames. If our frames are large, then we shall be obliged to construct special nucleus hives. These are small hives, need not be more than six inches each way, that is, in length, breadth, and thickness, and made to contain from four to six frames of corresponding size. These frames are filled with comb. I have for the last two or three years used the first named style of nucleus hive, and have found it advantageous to have about two long hives made, each to contain five chambers, each of which is entirely separate from the one next to it, and five inches wide. Each chamber is covered by a separate, close-fitting board, and the whole by a common cover. The entrance for the two end chambers is at the ends near the same side of the hive. The middle chamber has its entrance at the middle of the side near which are the end entrances, while the other two chambers open on the opposite side, as far apart as is possible. The outside might be painted different colors to correspond with the divisions, if thought necessary, especially on the side with two openings. Yet I have never taken this precaution, nor have I been troubled by losing queens. They have invariably entered their own apartments when returning from their wedding tour. These hives I use to keep queens during the summer. In spring I make use of my hives which are prepared for prospective summer use, for my nuclei. Now go to different hives of the apiary, and take out three frames for each nucleus, at least one of which has brood, and so on, till there are as many nuclei prepared as you have queen cells to dispose of. The bees should be left adhering to the frames of comb, only we must be certain that the queen is not among them, as this would take the queen from where she is most needed, and would lead to the sure destruction of one queen cell. I usually shake off into the nucleus the bees from one or two more frames, so that, even after the old bees have returned, there will still be a sufficient number of young bees left in the nucleus to keep the temperature at a proper height. If any desire the nuclei with smaller frames, these frames must of course be filled with comb, and then we can shake bees immediately into the nuclei, as given above, till they shall have sufficient to preserve a proper temperature. In this case the queen cell

should be inserted just before the bees are added; in the other case, either before or after. To insert the queen cell—for we are now to give one to each nucleus, so we can never form more nuclei than we have capped queen cells—we first cut them out, commencing to cut on either side the base of the cell, at least one-half inch distant, *we must not in the least compress the cell,* then cutting up and out for two inches, then across opposite the cell. This leaves the cell attached to a wedge-shaped piece of comb, whose apex is next the cell. A similar cut in the middle frame of the nucleus, which in case of the regular frames, is the one containing brood, will furnish an opening to receive the wedge containing the cell. The comb should also be cut away beneath so that the cell cannot be compressed. After all the nuclei have received their cells and bees, they have only to be set in a shady place and watched to see that sufficient bees remain. Should too many leave, give them more by removing the cover and shaking a frame loaded with bees over the nucleus; keep the opening nearly closed, and cover with a quilt. The main caution in all this *is to be sure not to get any old queen in a nucleus.* In two or three days the queens will hatch, and in a week longer will have become fertilized, and that, too, by selected drones, for as yet there are no other in the apiary, and the apiarist will possess from ten to thirty-five queens, which will prove his best stock in trade. I cannot overestimate the advantage of ever having extra queens. By keeping empty frames and empty cells in the nuclei, the bees may be kept active, yet with so few bees one cannot expect very much of them. After cutting all the queen cells from our old hive, we can again insert eggs and obtain another lot of cells, or if we have a sufficient number, we can leave a single queen cell, and this colony will soon be the happy possessor of a queen, and just as flourishing as if the even tenor of its ways had not been disturbed.

HOW TO MULTIPLY COLONIES WITH THE BEST RESULTS.

We have already seen the evils of natural swarming, which, even though no stock is too much reduced in numbers, no colony lost by not receiving prompt attention, no Sunday quiet disturbed, and no time wasted in anxious watching, yet, at best, the old colony is queenless for about two weeks, *a state of things which no apiarist can or should afford.* The true policy, then, is to practice

ARTIFICIAL SWARMING.

This method of procedure will divide evenly, will increase our number of colonies just to our liking, and with the least possible disturbance, will prevent loss of time, and is in every respect safer and to be preferred to natural swarming. I have practiced artificial swarming ever since keeping bees, and *never without the best results.*

HOW TO DIVIDE.

By the process already described, we have secured a goodly number of fine queens, which will be in readiness at the needed time. Now, as soon as the white clover harvest is well commenced, early in June, we may commence operations. If we have but one colony to divide, it is well to wait till they become pretty populous, but not till they swarm. Take one of our waiting hives, which now holds a nucleus and fertile queen, and remove the same close along side the colony we wish to divide. This must only be done on warm days when the bees are active, and better be done while the bees are busy, in the middle of the day. Remove the division board of the new hive, and then remove five combs, well loaded with brood, and of course containing some honey, from the old colony, bees and all, to the new hive. Also take the remaining frames and shake the bees into the new hive. *Only be sure that the queen still remains in the old hive.*

Fill both the hives with empty frames, and return the new hive to its former position. The old bees will return to the old colony, while the young ones will remain peaceably with the new queen. The old colony will now contain at least seven frames of brood, honey, etc., the old queen, and plenty of bees, so that they will work on as though naught had transpired, though perhaps moved to a little harder effort by the added space and five empty frames. The empty frames may be all placed at one end, or placed between the others, though not so as to divide brood. The new colony will have eight frames of brood, comb, etc., three from the nucleus and five from the old colony, a young fertile queen, plenty of bees, those of the previous nucleus and the young bees from the old colony, and will work with a surprising vigor, often even eclipsing the old colony.

If the apiarist has several colonies, it is better to make the new colony from several old colonies, as follows: Take one frame of brood comb from each of six old colonies, or two from each of three, and carry them, bees and all, and place with the nucleus. *Only*, be sure that no *queen is removed.* Fill all the hives with empty frames, as before. In this way we increase without in the least disturbing any of the colonies, and may add a colony every day or two, or perhaps several, depending on the size of our apiary, and can thus always, so my experience says, prevent swarming. These are unquestionably the best methods to divide, and so I will not complicate the subject by detailing others. The only objection that can be urged against them is that we must seek out the queen in each hive, or at least be sure that we do not remove her, though this is by no means so tedious if we have Italians, as of course we all will. I might give methods which would render unnecessary this caution, but they are inferior, and not to be recommended. If we proceed as above described, the bees will seldom prepare to swarm at all, and if they do they will be discovered in the act, by such frequent examinations, and the work may be cut short by at once dividing such colonies as first explained, and destroying their queen cells, or, if desired, use them for forming new nuclei.

HOW TO HANDLE BEES.

But, says one, Shall we not be stung to death? *No one* need be stung. Bees should never be jarred, nor irritated by quick motions. Those with nervous temperaments—and I plead very guilty on this point—need not give up, but at first better protect their faces, and perhaps even their hands, till time and experience show them that fear is vain; then they will divest themselves of all such useless encumbrances.

THE BEST BEE-VEIL.


FIG. 14.

This should be made of black tarlatan, sewed up like a bag, a half yard long, and with a diameter of the rim of a common straw hat, without top or bottom. Gather the top with braid, so that it will just slip over the crown of the hat, and the bottom with rubber cord or rubber tape, so that it may be drawn over the hat rim, and then over the head as we adjust the hat. When in use (Fig. 14), the rubber cord draws the lower part close about the neck, and we are safe. This kind of a veil is cool, does not impede vision at all, and can be made by any woman at a cost of less than twenty cents. Common buckskin or sheepskin gloves can be used, as it will scarcely pay to get special gloves for the purpose, for the most timid person,—I speak from experience,—will soon consider gloves as an unnecessary nuisance.

TO QUIET BEES.

In harvest seasons the bees, especially if Italians, can almost always be handled without their showing resentment. But at other times, and whenever they object to necessary familiarity, we have only to cause them to fill with honey to render them harmless, unless we pinch them. This can be done either by closing the hive, so that they cannot get out, and then rapping on the hive for four or five minutes. Those within will fill with honey, those from without will be tamed by surprise, and all will be quiet. Another method, more convenient, is to smoke the bees. A little smoke blown among the bees will scarcely ever fail to quiet them, though I have known black bees in autumn to refuse to yield. Dry cotton cloth, closely wound and sewed or tied, or, better, pieces of dry rotten wood, are excellent for purposes of smoking. These are easily handled and will burn for a long time. But best of all is a

QUINBY SMOKER.

This is a tin tube attached to a bellows. Cloth or rotten wood can be burned in the tube, and will remain burning a long time. The smoke can be directed at pleasure, the bellows easily worked, and the smoker used without any disagreeable effects or danger from fire. It can be got of any dealer in bee apparatus, and only costs $1.50. I most heartily recommend it to all. It was patented by the late Mr. Quinby, to whom American bee-keepers are so greatly indebted, and I think he reserved the entire right to manufacture.

ROOM FOR STORING SHOULD ALWAYS BE PROVIDED.

Every apiarist has observed with uneasiness the frequent clustering of the bees outside the hive, in strange indolence, even when every flower is fragrant with sweet. A prolific cause of such expensive idleness is a too confined space within the hive, and no room for further storing. The evil may be prevented or removed in three ways:

First—By dividing the bees as already described, we shall remove a portion of the bees, give empty frames, and by removing the cause, prevent or overcome the evil.

Secondly—We may give more room for storing by using the extractor, whenever extracted honey is profitable, and as we have already seen, we must do this if the queen has not room for egg-laying.

Thirdly—We can add more frames, either at the side or above, as our hive permits (see section on hives), or add surplus honey boxes if we desire our surplus in comb and in the best form to suit the market.

IN WHAT FORM TO SECURE OUR SURPLUS COMB HONEY.

As before stated, if we can get fifteen or twenty cents for extracted honey, we shall not care to work for that in the comb, and only allow surplus in those drone combs, a few of which will steal in, despite the most wary apiarist. Otherwise we will arrange for comb-honey. This will be most readily and abundantly secured in frames, which may be suspended at the side of, or above, the brood frames. These frames may be the usual size, or half, or quarter size. The method of construction will be described in the sequel. The objection that some urge to this arrangement is, that the frame honey does not meet such ready sale or receive as high prices as that in boxes, yet the retail dealers in Lansing prefer it. Whether the extra amount will compensate for the lower

price must be decided by each apiarist, as it will depend wholly on the locality. If boxes are preferred, they should be so made as to best attract the buyer, and put in place as soon as the brood chamber is well filled, which, with proper management, will be at the opening of the white clover harvest. As soon as storing ceases, the boxes or frames should be removed, as the comb will keep brighter, and the boxes freer from bee-glue. If not full they can be returned as storing is resumed. To free the boxes of bees when removed, they should be placed in a close box, which should be all covered from the light except one little opening, and through this the bees will escape to their hive. Should robbers enter, leave the large box uncovered except by a thin sheet, which can be turned over as the bees collect on it.

Boxes containing honey should be placed in dry, cool rooms, secure from mice and moths, and it would be well to place them in a close box the third day after their removal from the hive, and burn some sulphur in the box. The fumes would do no injury to the honey, and would destroy any inchoate moths. (The methods of making, preparing, and adjusting boxes will be described under hives.)

HIVES SHADED.

Bees are also forced to cluster outside the hive, where the hives are subjected to the full force of the sun's rays. By the intense heat the temperature inside becomes like that of an oven, and the wonder is that they do not desert entirely. I have known hives thus unprotected to be covered by bees idling outside, when by simply shading the hives all would go merrily to work. The combs, too, are liable, in unshaded hives, to melt and fall down, which is very damaging to the bees, and very vexatious to the apiarist. The remedy for all this is to always have the hives so situated that they will be entirely shaded all through the heat of the day. This might be done by constructing a shed or house, but these are expensive and inconvenient, and therefore to be discarded. Perhaps the Coe house apiary may prove an exception; but, as yet, we have no reliable assurance of the fact. If the apiarist has a convenient grove, this may be trimmed high, so as not to be damp, and will fulfill every requirement. So arrange the hives that, though they are shaded through all the heat of the day, they will receive the early and late rays, and thus work more hours. I always face my hives to the east. If no grove is at command, the hives may be placed on the north of a Concord grape vine, or evergreen, which may soon be secured for the purpose. Norway spruce is the best. These should be at least six feet apart. A. I. Root's idea of having the vines of each succeeding row divide the spaces of the previous row, in quincunx order, is very good; though I should prefer the rows in this case to be four, instead of three feet apart, especially with evergreens. The same gentleman's idea of having sawdust under and about the hives is a good one. The hives of the Michigan Agricultural College are protected by evergreens, trimmed close on the north side. A space four feet by six, north of the shrubs, was then dug out to a depth of four inches, and filled with sawdust, underlying which were old bricks, so that nothing would grow up through the sawdust. The sawdust thus extends one foot back, or west of the hive, three feet north, and the same distance east, or in front. This makes it neat about the hive, and largely removes the danger of losing the queen in handling the bees; as should she fall outside the hive, the sharp-sighted apiarist would be very likely indeed to see her. Until protecting shade can be thus permanently secured, boards should be arranged for temporary protection. Many apiarists

economize by using fruit trees for this purpose, which, from their spreading tops, answer very well.

THE APIARY SHOULD BE IN MIDST OF HONEY PLANTS.

As bees do not make honey, but only gather it, and as honey is mainly derived from certain flowers, it of course follows that the apiarist's success will depend largely upon the abundance of honey-secreting plants in the vicinity of his apiary. True it is that certain bark and plant lice secrete a kind of liquid sweet—honey of doubtful reputation—which, in the dearth of anything better, the bees seem glad to appropriate. I have thus seen the bees thick about a large bark-louse which attacks the tulip tree, and thus often destroys one of our best honey trees. This is an undescribed species of the genus *Lecanium.* I have also seen them thick about three species of plant lice. One, the *Pemphigus imbricator,* Fitch, works on the beech tree. Its abdomen is thickly covered with long wool, and it makes a comical show as it wags this up and down upon the least disturbance. The leaves of trees attacked by this louse, as also those beneath the trees, are fairly gummed with a sweetish substance. I have found that the bees avoid this substance, except at times of extreme drouth and long protracted absence of honeyed bloom. It was the source of no inconsiderable stores during the terribly parched autumn of Chicago's great disaster. Another species of *Pemphigus* gives rise to certain solitary plum-like galls, which appear on the upper surface of the red elm. These galls are thin-skinned, and within the hollows are the lice, and their abundant sweet often attracts the bees, as to a feast of fat things, as the gall is torn apart, or cracks open, so that the sweet exudes. This sweet is anything but disagreeable, and may not be unwholesome to the bees. Another, black aphis, works on the branches of our willows, which they often entirely cover, and thus greatly damage another tree valuable for both honey and pollen. Were it not that they seldom are so numerous two years in succession, they would certainly banish from among us one of our most ornamental and valuable honey-producing trees. These are fairly thronged in September and October by bees, wasps, ants, and various two-winged flies, all eager to lap up the oozing sweets. This louse is doubtless the *Lachnus dentatus,* of Le Baron, and the *Aphis salicti,* of Harris. Bees also get, in some regions, a sort of honey-dew, which enables them to add to their stores with surprising rapidity. I remember one morning while riding on horseback along the Sacramento River, in California, I broke off a willow twig beside the road, when, to my surprise, I found it was fairly decked with drops of honey. Upon further examination I found the willow foliage was abundantly sprinkled by these delicious drops. These shrubs were undisturbed by insects, nor were they under trees. Here then was a real case of honey-dew, which must have been distilled through the night by the leaves. I never saw any such phenomenon in Michigan; still honey-dew may be a product even of our State. Has anyone undoubted evidence on the subject? Bees also get some honey from oozing sap, some of questionable repute from about cider mills, some from grapes and other fruit which have been crushed, or eaten and torn by wasps and other insects. That bees ever tear the grapes is a question of which I have failed to receive any personal proof, though for years I have been carefully seeking it. I have lived among the vineyards of California, and have often watched bees about vines in Michigan, but never saw bees tear open the grapes. I have laid crushed grapes in the apiary, when the bees were not gathering, and were ravenous for stores, which, when covered with sipping bees, were replaced with sound

grape clusters, which in no instance were mutilated. I have thus been led to doubt if bees ever attack sound grapes, though quick to improve the opportunities which the oriole's beak and the stronger jaws of wasps offer them. Still, Prof. Riley feels sure that bees are sometimes thus guilty, and Mr. Bidwell tells me he has frequently seen bees rend sound grapes, which they did with their feet. Yet, if this is the case, it is certainly of rare occurrence, and is more than compensated by the great aid which the bees afford the fruit-grower in the great work of cross-fertilization, which is imperatively necessary to his success, as has been so well shown by Dr. Gray and Mr. Chas. Darwin. It is true that cross-fertilization of the flowers, which can only be accomplished by insects, and early in the season by the honey-bee, is often, if not always necessary to a full yield of fruit and vegetables. Even then, if Mr. Bidwell and Prof. Riley are right, and the bee does, rarely—for surely this is very rare, if ever—destroy grapes, still they are, beyond any possible question, invaluable aids to the pomologist.

But the principal source of honey is still from the flowers.

WHAT ARE THE VALUABLE HONEY PLANTS?

In the northeastern part of our country the chief reliance for May is the fruit-blossoms, willows, and sugar maple. In June white clover yields largely of the most delicious honey, both as to appearance and flavor. In July the incomparable bass-wood makes both bees and apiarist jubilant. In August buckwheat offers its tribute, which we welcome, though it be dark, and pungent in flavor, while with us in Michigan, August and September give us a profusion of bloom which yields to no other in the richness of its capacity to secrete honey, and is not cut off till the autumn frosts,—usually about Sept. 15. Thousands of acres of golden rod, boneset, asters, and other autumn flowers of our new northern counties, as yet have blushed unseen, with fragrance wasted. This unoccupied territory, unsurpassed in its capability for fruit production, covered with grand forests of maple and bass-wood, and spread with the richest of autumn bloom, offers opportunities to the practical apiarist rarely equalled except in the Pacific States, and not even there, when other privileges are considered. In these localities two or three hundred pounds to the colony is no surprise to the apiarist, while even four or five hundred are not isolated cases.

In the following table will be found a list of valuable honey plants. Those in the first column are herbaceous or perennial, the herbaceous being enclosed in a parenthesis thus: () while those in the second are shrubs or trees, the names of shrubs being enclosed in a parenthesis. The date of commencement of bloom is, of course, not invariable. The one appended is about average for Central Michigan. Those plants whose names appear in small capitals yield very superior honey. Those with a line beneath are useful for other purposes than honey secretion. Those with a * are native or very common in Michigan. Those written in the plural refer to more than one species, while those followed by a † are very numerous in species. Of course I have not named all, as that would include some hundreds which have been observed at the college, taking nearly all of the two great orders Compositæ and Rosaciæ. I have only aimed to give the most important, omitting many foreign plants of notoriety, as I have had no personal knowledge of them.

DATE.	ANNUALS OR PERENNIALS.	DATE.	SHRUBS OR TREES.
May........	* Strawberry	May........	* (Willows.) †
May to June	* Dandelion.	"	* Maples—Sugar Maple.
June	* WHITE CLOVER.	"	* Crab Apple.
"	Catnip.	"	* Hawthorns.
"	Hoarhound.	"	* Fruit Trees. Apple, Plum, Cherry, Pear, etc.
"	* Mother-wort.	"	* (Currant and Gooseberry.)
"	ALSIKE CLOVER.	May to June	* Tulip-tree.
"	* Borage.	" "	* (Grape-vine.)
"	Sage.	June........	* Wild-plum.
June to July	* Ox-eyed Daisy—bad weed.	"	* (Black Raspberry.)
" Aug.	* Bush Honeysuckle.	"	* Locusts.
" "	(MELILOT.)	"	* (RED RASPBERRY.)
" "	* Mustard. †	"	* (Sumach.) †
" "	Rape.	"	* Blackberry.
" Sept.	* St. John's Wort.	July	* BASS-WOOD.
July to Aug.	* Silk or Milk weeds.	"	* (Virginia Creeper.)
" "	* Boneset.	July to Sep.	(St. John's Worts.
August.....	* (Buckwheat.)		
"	* Asparagus.		
"	* Snap-dragon.		
Aug. to Sep.	* GOLDEN ROD. †		
" "	* Asters. †		
" "	* Stick-tights †—Coreopsis.		
" "	(Minnesota bee-plant) —Polanisia.		

HOW TO WINTER.

This is the subject, of course, of paramount importance to the apiarist, as this is the rock on which some of even the most successful have recently split. Yet I come fearlessly to consider this question, as from all the multitude of disasters I see no occasion for discouragement. If the problem of successful wintering has not been solved already, it surely will be, and that speedily. So important an interest was never yet vanquished by misfortune, and there is no reason to think that history is now going to be reversed. Even the worst aspect of the case, in favor of which there is no proof, and but few suggestions even, that these calamities are the effects of an epidemic, would be all powerless to dishearten men trained to reason from effect to cause. Even an epidemic—which would by no means skip by the largest, finest apiaries, owned and controlled by the wisest, most careful, and most thoughtful, as has been the case in the winters of our late discontent—would surely yield to man's invention.

WHAT THEN IS THE CAUSE?

Epidemic then, being set aside as no factor in the solution, to what shall we ascribe such wide-spread reverses. I fully believe, and to no branch of this subject have I given more thought, study, and observation, that all the losses may be traced either to unwholesome food, failure in late breeding of the previous year, extremes of temperature, or to protracted cold with excessive dampness. I know from actual and wide-spread observation, that the severe loss of 1870 and 1871 was attended in this part of Michigan with unsuitable honey in the hive. The previous autumn was unprecedentedly dry. Flowers were rare, and storing was largely from insect secretion, and the stores unwholesome. I tasted

of honey from many hives only to find it most nauseating. I fully believe that had the honey been thoroughly extracted the previous autumn, and the bees fed good honey or sugar, no loss would have been experienced. At least it is significant that all who did so, escaped, even where their neighbors all failed. Nor less so the fact that when I discovered eight of my twelve colonies dead, and four more just alive, I cleaned the remaining ones all out, and to one no worse nor better than the others I gave good capped honey stored early the previous summer, while the others were left with their old stores, that that one lived and gave the best record I have ever known, the succeeding season, while all the others died.

Again, suppose that after the bass-wood season in July, there is no storing of honey, either from want of space, or from lack of bloom. In this case brood-rearing ceases. Yet if the weather is dry and warm, as of course it will be in August and September, the bees continue to wander about, death comes apace, and by autumn the bees are reduced in numbers, old in days, and illy prepared to brave the winter and perform the duties of spring. I fully believe that if all the colonies of our State and country had been kept breeding by proper use of the extractor, and feeding even till into October, we should have had a different record, especially as to spring dwindling, and consequent death. In the autumn of 1872 I kept my bees breeding till the first of October. The following winter I had no loss, while my neighbors lost all of their bees.

Extremes of heat and cold are also detrimental to the bees. If the temperature of the hive becomes too great the bees become restless, eat more than they ought, and if confined to their hives are distended with their fœces, become diseased, besmear their comb and hives, and die. If when they become thus disturbed, they could have a purifying flight, all would be well.

Again, if the temperature becomes extremely low, to keep up the animal heat more food must be taken; they are uneasy, exhale much moisture, which may settle and freeze on the outer combs about the cluster, preventing the bees from getting the needed food, and thus in this case both dysentery and starvation confront the bees. I have little doubt, in fact I know from actual investigation that in the past three severe winters, those bees which under confinement have been subject to severe extremes, are the ones that have invariably perished. Had the bees been kept in a uniform temperature ranging from 35° to 45° F., the record would have been materially changed.

Excessive moisture, too, especially in cases of protracted cold, is always to be avoided. Bees, like all other animals, are constantly giving off moisture, which of course will be accelerated if the bees become disturbed, and are thus led to eat more. This moisture not only acts as explained above, but also induces fungus growths. The mouldy comb is not wholesome, though it may never cause death. Hence another necessity of sufficient warmth to drive this moisture from the hive and some means to absorb it without opening the hive above and permitting a current, which will disturb the bees, and cause the greater consumption of honey.

THE REQUISITE TO SAFE WINTERING.

To winter safely then demands that the bees have thirty pounds of good capped honey (coffee A sugar is just as good). If desired this may be fed as previously explained, which should be done so early that all will be capped during the warm days of October. I prefer too that some of the comb on the centre of the hive has empty cells, to give a better chance to cluster, and that all the combs have a small hole through the centre, that the bees may pass

freely through. This hole may simply be cut with a knife, or a tin tube the size of one's finger may be driven through the comb, and left in if desired, in which case the comb should be pushed out of the tube, and the tube be no longer than the comb is thick.

Keep the bees breeding till the first of October. Except in years of excessive drouth, this will occur in many parts of Michigan without extra care. Failure may result from the presence of worthless queens. Any queens which seem not to be prolific should be superseded whenever the fact becomes evident. *I regard this as most important.* Few know how much is lost by tolerating feeble, impotent queens in the apiary, whose ability can only keep the colony alive. Never keep such queens about. Here, then, is another reason for always keeping extra queens on hand. Even with excellent queens, a failure in the honey yield may cause breeding to cease. In such cases, we have only to feed as directed under the head of feeding.

We ought also to provide against extremes of temperature. If no cellar or house is at hand, this may be accomplished as follows: Some pleasant dry day in late October or early November raise the stand and place straw beneath; then surround the hive with a box a foot outside the hive, with movable top, and open on the east; or else have a long wooden tube, which will permit the bees to fly. The same end may be gained by driving stakes and putting boards around. Now crowd between the box and the hive either straw, chaff, or shavings. After placing a good thickness of straw above the hive, lay on the cover of the box, or cover with boards. This preserves against changes of temperature during the winter, and also permits the bees to fly if it becomes necessary from a protracted period of warm winter weather. I have thus kept all my bees safely during two of the disastrous winters.

With large apiaries the above method is too laborious, and a cellar or special depository is necessary. After my experience last winter, losing all my bees by keeping them in a house with double walls filled in with saw-dust, in which the thermometer indicated a temperature below zero for several weeks, in which time my strongest colonies literally starved to death in the manner already described, I hesitate to recommend a house above ground for Michigan, though with very numerous colonies it might do. Such a house must, if it answer the purpose, keep an equable temperature, at least 3° above freezing, and not more than ten, be perfectly dark, and ventilated with tubes above and below, so arranged as to be closed or opened at pleasure, and not admit a ray of light.

A cellar in which we are sure of our ability to control the temperature, needs to be also dry, dark, and quiet, and ventilated as described above. My cellar is grouted throughout, which makes it more dry and neat. Of course it should be thoroughly drained.

The colonies should be put into the depository when the hive is dry, before cold weather, and may remain with good results till April; though in January and March, if there are days that are warm, they should be taken out and the bees permitted to fly, especially if they seem uneasy and soil the entrance of their hives. *Always* when taken out they should be placed on their old stands, so that no bees may be lost. Towards night, when all are quiet, replace them in the cellar. In moving the hives, great care should be exercised not to jar them. It were better if the bees should not know that they were being moved at all.

That the moisture may be absorbed, I cover the bees with a quilt, made of coarse factory cloth, enclosing a layer of cotton batting. Above this I fill in with straw which is packed in so closely that the cover may be removed without

the straw falling out. This is not only an excellent absorbent, but preserves the heat, if allowed to remain, till the following June.

I have found it advantageous, when preparing my bees for winter, in October, to contract the chamber by use of a division board. This is very desirable if wintered out doors, and with frames a foot square is very easily accomplished. By use of eight frames the space (one cubic foot) is very compact, and serves to economize the heat, not only in winter, but in spring.

Perhaps I ought to say that all colonies should be strong in autumn. But I have said before, never have weak colonies. Yet for fear some have been negligent, I remark that weak colonies should be united in preparing for winter. To do this, approximate the colonies each day four or five feet till they are side by side. Now remove the poorest queen, then smoke thoroughly, sprinkle both colonies with sweetened water scented with essence of peppermint, putting a sufficient number of the best frames and all the bees into one of the hives, and then set this midway between the position of the hives at the commencement of the uniting. The bees will unite peaceably, and make a strong colony. Uniting of colonies may pay at other seasons. It may seem rash to some, yet I fully believe that if the above suggestions are carried out in full, I may guarantee successful wintering. But if we do lose our bees, with all our hives, combs, and honey, we can buy colonies in the spring, with a perfect certainty of making 300 or 400 per cent. on our investment. Even with the worst condition of things, we are still ahead, in way of profit, of most other vocations.

FOUL BROOD.

Just here it is very proper to speak of this dreaded disease. This disease, though it has occurred in our State as well as in States about us, is not familiar to me, I having never seen but one case, and that on Kelly's Island, the past summer, where I found it had reduced the colonies on that Island to two.

The symptoms are as follows: Decline in the prosperity of the colony, because of failure to rear brood. The brood seems to putrefy, becomes black and gives off a stench which is by no means agreeable, while later the caps have a little hole through them. So far, the cause is obscure, though the disease seems to be gendered by feeding upon the honey.

It is stated by some that transferring the bees to an empty hive, and preventing brood-rearing till all the honey conveyed in the bees' stomachs is consumed, is a cure. In this case the honey from the old hive must be kept from all the bees, or the spread of the disease will be certain. Others advise total destruction of affected colonies, honey, hives, and all. The disease is a very serious one, and the symptoms should be understood by all, that its spread may be prevented. More, the whole subject should be investigated by the most competent scientific authorities. What better work for the bee-keepers of our country than to memorialize Congress on this subject.

ALL SHOULD KEEP ONLY ITALIANS.

The advantages of the Italians, which have been already considered as fully as necessary, are more than sufficient to warrant the exclusion of any other bees from the apiary. Truly no one need to be urged to a course that adds to the ease, profit, and agreeableness of his vocation.

HOW TO ITALIANIZE.

From what has been already explained as to the natural history of bees, it will be seen that all we have to do to change our bees, is to change our queens.

Hence to Italianize a colony we have only to procure and introduce an Italian queen.

HOW TO INTRODUCE A QUEEN.

In dividing colonies, where we give our queen to a colony composed wholly of young bees, it is safe and easy to introduce a queen in manner as explained in the section on artificial swarming. To introduce a queen to a colony composed of old bees more care is required. First, we should seek out the old queen and destroy her, then cage our Italian queen in a wire cage, which may be made by winding a strip of wire cloth, three and one-half inches wide, and containing fifteen to twenty meshes to the inch, about the finger. Let it lap each way one-half inch, then cut it off. Ravel out the half inch on each side, and weave in the ends of the wires, forming a tube the size of the finger. We now have only to put the queen in the tube, and pinch the ends together, and the queen is caged. The cage may now be inserted between two adjacent combs containing honey, each of which will touch it. The queen can thus sip honey as she needs it. If we fear the queen may not be able to sip the honey through the meshes of the wire, we may dip a piece of clean sponge in honey and insert it in the upper end of the cage before we compress the end. This will furnish the queen with the needed food. In 48 hours we again open the hive, after a thorough smoking, also the cage, which is easily done by pressing the upper end, at right angles to the direction of the pressure when we closed it. In doing this do not remove the cage. Now keep watch and if as the bees enter the cage or as the queen emerges the bees attack her, secure her immediately and recage her for another 48 hours. I usually let some honey drip on the queen as soon as the cage is opened. Some think this renders the bees more amiable. I have introduced many queens in this manner, and never lost one, and never had to recage but one.

A young queen just emerging from a cell can almost always be safely given at once to the colony, after destroying the old queen.

A queen cell is usually received with favor. If we adopt this course we must be careful to destroy all other queen cells that may be formed; and if the one we supply is destroyed, wait seven days, then destroy all their queen cells, and they are sure to accept a cell. But to save time I should always introduce a queen.

If we are to introduce an imported queen, or one of very great value, we might make a new colony, all of young bees, as already described. Smoke them well, sprinkle with sweetened water, daub the queen with honey, and introduce immediately. This method would involve really no risk.

By having a colony thus Italianized in the fall, we may commence the next spring, and, as described in the section explaining the formation of artificial swarms, we may control our rearing of drones, queens, and all, and ere another autumn have only the beautiful, pure, amiable, and active Italians. I have done this several times, and with the most perfect satisfaction. I think by making this change in blood we add $5 to the value of each colony, and I know of no other way to make money so easy and pleasantly.

WHAT STYLE OF HIVES SHALL WE USE?

I feel free to say that no person who reads, thinks, and studies,—and success in apiculture can be promised to no other,—will ever be content to use the old box hives. In fact, thought and intelligence, which imply an eagerness to

investigate, are essential elements in the apiarist's character. And to such an one a box hive would be valued just in proportion to the amount of kindling-wood it contained. A very serious fault with one of our principal bee books which otherwise is mainly excellent in subject matter and treatment, is the fact that it presumes its readers are box-hive men. As well make emperors, kings, and chivalry the basis of good government, in an essay written for American readers. I have entirely ignored box-hives in the previous discussions, for I believe no sensible, intelligent apiarist, such as read books, will tolerate them, and that, supposing they would, it would be an expensive mistake, which I have no right to encourage, in fact, am bound to discourage, not only for the benefit of individuals, but also for the art itself.

For the movable frame hive, the world is indebted to the Rev. L. L. Langstroth, and for this gift, as well as his able researches in apiculture, as given in his invaluable book, "The Honey Bee," he has conferred a benefit upon our art which cannot be over-estimated, and for which we, as apiarists, cannot be too grateful. It was his book, one of my old teachers for which I have no word of chiding, that led me to some of the most delightful investigations of my life. It was his invention that enabled me to make those investigations. For one, I shall always revere the name of Langstroth, as the great leader in scientific apiculture, not only in America, but throughout the world. His name must ever stand beside that of Dzierzon and the elder Huber.

To be sure of success, the apiarist must be able to inspect the whole interior of the hive at his pleasure, must be able to exchange combs from one hive to another, to regulate the movements of the bees: by destroying queen cells, by giving or withholding drone comb, by extracting the honey, by introducing queens, and by many other manipulations already explained, which are only practicable with a movable frame hive.

CHARACTER OF THE HIVE.

The main feature of the hive should be simplicity, which would exclude doors, drawers, and traps of all kinds. The body should be made of good pine or white-wood lumber, one inch thick, thoroughly seasoned, and planed on both sides. It should be simply a plain box (Fig. 15) without top or bottom, though some prefer to have a bottom, and of a size and form to suit the apiarist. The size will depend upon our purpose. If we desire no comb honey, or desire comb honey in frames, the hive may contain 4,000 cubic inches. If we desire honey in boxes, it should not contain over 2,000, and may be even smaller. A one-inch rabbet should be cut from the top of the sides or ends, as the apiarist prefers, on the inside. (Fig. 15 *c*.) The rabbet may equal one-half the thicknes of the board. Heavy tin strips $\frac{3}{4}$ of an inch wide should be tacked to the side below the rabbet, so as to reach one-fourth of an inch above the shoulder. For a bottom board (Fig.

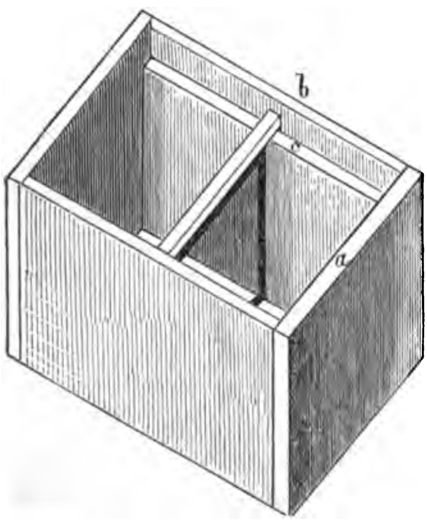

FIG. 15.

16), or stand, we should have a single one-inch board (*b*, Fig. 16) four inches wider than the hive, and six inches longer. This is nailed on to two pieces of two-by-four-inch scantling (*a a* Fig. 16), thus raising the hive five inches from

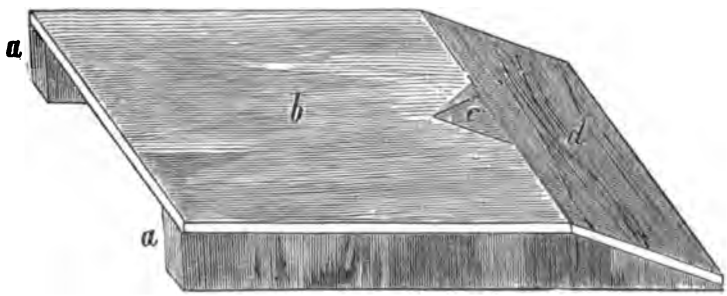

FIG. 16.

the ground. These scantling should extend at one end eight inches beyond the board, and this projection beveled from the edge of the board to the lower outer corner of the scantling. Upon this bevel nail a board (*d* Fig. 16), which shall reach from the edge of the bottom board to the ground. The upper edge of this board should be so beveled as to fit closely to the bottom board. For an opening (*c* Fig. 16) to the hive, I would bevel the middle of the edge of the bottom board, next to the inclined board. At the edge, this bevel should be ⅜ of an inch deep and four inches wide. It may decrease in both width and depth as it runs back, till at a distance of five inches it is one-half inch wide and 5-32 of an inch deep. This may terminate the opening, though the shoulder at the end may be beveled off, if desired.

With this bottom board the bees are near the ground, and with the slanting board in front, even the most tired and heavily laden will not fail to gain the hive as they come in with their load of stores. *No hive should be more than four inches from the ground,* and no hive should be without the slanting alighting-board. With this opening, too, the entrance can be contracted in case of robbing, or entirely closed when desired, by simply moving the hive back. If desired, the alighting-board may be separate from the bottom board or stand, and fastened to it by small hooks and staples, so in winter they can be removed, and the hives take less room in the cellar.

If we only purpose to have our surplus in boxes, or if we prefer a long hive, styled the "New Idea," we have only to make a cover about seven inches high, like the lid of a trunk. This may be the same size as the body of the hive, and fit on with beveled edges, and fastened with hook and staple, the body of the hive having the outer edge beveled, while the cover has the inner edge beveled. Or it may be enough larger to shut over the body, and rest on shoulders formed by nailing inch strips around the body, two inches from the top. Some prefer the upper part to be just like the lower, and occupied by a similar frame. In this case the two should unite with a bevel, as explained above, while the cover may be as just described, except that it need not be more than two inches deep.

THE FRAMES.

The form and size of frames, though not quite as various as the persons who use them, are still very different. Some prefer large frames. I first used one 10 by 18 inches, and afterward a shallow frame about 7 by 18. The advantage

claimed for such large frames is that there are less to handle, and time is saved. The advantage of the shallow frame is, as claimed, that the bees will go into boxes more readily; yet they are not considered so safe for out-door wintering. Another frame in common use is one about one foot square. I use one 11¼ inches square. The reasons that I prefer this form are, that the comb seldom breaks from the frame, the frames are convenient for nuclei, and save the expense of constructing extra nucleus hives, and that these frames permit the most compact arrangement for winter and spring, and thus enable us to economize heat. By use of a division board we can, by using eight of these frames, occupy just a cubic foot of space in spring, and by repeated experiments I have found that a hive so contracted that the bees always cover the combs during the early cold weather, always gives the best results.

HOW TO CONSTRUCT THE FRAMES.

In this description I shall suppose that the frames desired, are of the form and size (Fig. 17), which I use. It will be easy for any who may desire, to change the form at pleasure.

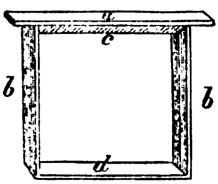

FIG. 17.

For the top bar (*a* Fig. 17) of the frame, use a triangular strip 12½′ long, with each face of the triangle 1′ across. One-half an inch from each end of this, form a shoulder, by sawing from one angle to within ⅜ of an inch of the opposite face, so that when the piece is split out from the end, these projections shall be just ⅜ of an inch thick throughout. For the side pieces take (*b b* Fig. 17,) strips 11⅜ inches long by ¾′ by 3-10′. Tack with small brads the end of two of these strips firmly to the shoulder of the top-bar, taking pains that the end touches squarely against the projection. Now tack the opposite ends or bottoms to the ends of a similar strip (*d* Fig. 17,) 11¼′ long. We shall thus have a square frame. The timber should be thoroughly seasoned, and of the best pine or white-wood. Care should be taken that the frame be made so as to hang vertically, when suspended on the rabbets of the hive. In making frames a good mitre box is indispensable. The projecting ends of the top-bar will rest on the tins, and thus the frame can be easily loosened at any time without jarring the bees, as the frames will not be glued fast, as they would in case they rested on the wooden rabbets.

COVER FOR FRAMES.

Nothing that I have ever tried is equal to a quilt for this purpose. It is a good absorbent of moisture, preserves the heat in spring and winter, and can be used in summer without jarring or crushing the bees. This should be a real quilt, made of firm unbleached factory, enclosing a thick layer of batting, and hemmed about the edges. My wife quilts and hems them on a machine. The quilting is in squares, and all is made in less than fifteen minutes. The quilt should be a little larger than the top of the hive, so that after all possible shrinkage, it will still cover closely. Thus when this is put on no bees can ever get above it. When we use the feeder, it may be covered by the quilt, and a flap cut in the latter, just above the hole in the feeder, enables us to feed without disturbing the bees, though I place the feeder at the end of the chamber, wherein are the bees, and have only to double the quilt back when I feed.

DIVISION BOARD.

A close fitting division board, for contracting the chamber, is very important, and though unappreciated by many excellent apiarists; still no hive is complete

without it. I find it especially valuable in winter and spring, and useful at all seasons. This is made the same form as the frames, though all below the top bar—which consists of a strip $12\frac{3}{4}'$ by $1'$ by $\frac{3}{8}'$, and is nailed firmly to the board below—is a solid inch board which is exactly one foot square, so that it fits closely to the inside of the hive. When this is inserted in the hive it entirely separates the chamber into two chambers, so that an insect much smaller than a bee could not pass from the one to the other.

BOXES.

These are for surplus comb honey in the most salable form. They may be of any size that best suits the taste of the apiarist, and the pulse of the market. It is well that the sides of these be of glass. Such (Fig. 18) may be made as follows: For top and bottom procure soft wood boards $\frac{1}{4}$ inch thick and of the size desired, one for the bottom and the other for the top of the box. Take four pieces $\frac{1}{2}$ inch square, and as long as desired height of the honey-box. In two adjacent sides of these saw grooves in which may slip common glass. These are for corner pieces. Now tack with small brads the corners of the bottom board to the ends of these pieces, then slide in the glass, and in similar way tack the top board to the other ends. Through the bottom board holes may be bored so the bees may enter. Another form which I find very desirable, and which I used in California more than ten years ago, is made as follows: Dress off common lath so that they are smooth, cut off two lengths the desired height of the box and one the desired width, tack this last piece to the ends of the other two, and to the other end tack a similar strip only half as wide. We now have a square frame. Place such frames side by side till a box is made of the desired length. To hold these together, we have now only to tack on either side one or two pieces of tin, putting a tack into each section, thus forming a compact box without ends. The end frames should have a whole piece of lath for the bottom, and groves should be cut in the bottom and top laths, so that a glass may be put in the ends. Of course there is ample chance for the bees to enter from below. Now by placing small pieces of comb, or artificial comb foundations, which rank as a discovery with the movable frame hive and honey extractor, on the top of each frame, the bees will be led to construct a separate comb in each frame, and each frame may be sold by the retail dealer separately, by simply drawing the tacks from the tins. Barker and Dicer, of Marshall, make a very neat sectional honey-box, which is quite like the above, except that paper pasted over the frames takes the place of the tins. The honey-boxes may be placed directly on the frames, or in case the queen makes trouble by entering them to deposit eggs,—a trouble which I have seldom met, perhaps because I give her enough to do below,—we can place strips $\frac{1}{2}$ inch square between the frames and boxes, thus placing that much space between them. In case we work extensively for box honey, we should have a rack so attached to the cover, that when we raise the cover, we shall remove all the boxes. Thus to examine the bees we would not have to remove all the boxes separately.

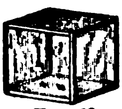

FIG. 18.

SURPLUS COMB HONEY IN FRAMES.

For our market, here at Lansing, we find a more ready sale for comb honey in frames. These frames sell best when about six by twelve inches in size and weigh about three pounds. In this case the purchaser sees all of the honey, and if nice it is very tempting. Mr. John Davis, of Delhi, Michigan, secures all of

his comb surplus in this form. If we use a two-story hive, these frames may be put in above, two deep, by plowing a horizontal groove in the centre of the side-boards, one-half inch wide, and of equal depth. The lower frames can be easily adjusted by turning them diagonally till lowered to the groove. I think it is generally better to rest content with one row of these frames, in which case we need only to have our upper story half as deep as the lower one, and arranged to take frames only half as deep.

I have found that I can get much more honey in such frames than I can in boxes.

GUIDE COMB.

I have spoken of placing guide comb in the boxes. Small pieces of worker comb or comb foundations may well be placed as a start in the top of the frames, and boxes should always have these guides. For the latter, drone comb is as good as worker. To fasten these we have but to dip the edges into melted bees-wax. Strips of comb one-half inch wide are sufficient. We thus see that pieces of worker comb, and bright pieces of drone comb should never be suffered to go to waste or melted into wax.

Many people have not the ability to readily understand a word painting as to any implement, machine, or structure. Should any such wish a hive or any of the above described articles, they had better take the descriptions to a good carpenter, who will have no difficulty in following the advice. Leave orders that the hives be thoroughly painted. After seeing a hive, any one will be able to make his own.

It would be still better to visit some good apiary, or if that is impossible, to send for a pattern hive, box, etc., to some reliable apiarist. Letters of inquiry sent to me will always receive prompt attention.

TO TRANSFER BEES FROM A COMMON BOX TO A MOVABLE COMB HIVE.

As many have bees already in common hives, and of course will desire to transfer them immediately into a movable-frame hive, I will now proceed to describe the process.

The best time to transfer is early in the season, when there is but little honey in the hives, though it may be done at any time, if sufficient caution is used. This should never be done except on warm days, when the bees are actively engaged in storing. After the bees get busy at work, approach the old hive, blow a little smoke into the entrance to quiet the bees, then carry the hive off four or five rods, and turn the hive bottom up. Place another hive or box, previously prepared, over the old one, and wind a sheet about where the hives come together, so that no bees can possibly get out. Place a box on the old stand, in which the bees that are out can cluster when they return. Now with a stick rap on the lower hive for about twenty minutes. The bees will fill with honey, and go with the queen into the upper hive and cluster. A few young bees will still remain in the old hive, but these will do no harm. Now put the top hive down, leaving the edge raised so the bees can get air. If other bees do not trouble, as they usually will not if busily gathering, we can proceed in the open air. If they do we must go into some room. I have frequently transferred the comb in my kitchen, and often in a barn. Now knock the old hive apart, cut the combs from the sides, and get the combs out of the old hive with just as little breakage as possible. We now need a barrel, set on end, on which we place a board fifteen to twenty inches square, covered with several thicknesses

of cloth. We now place a comb on this cloth, and a frame on the comb, and cut out the comb the size of the inside of the frame, taking pains to save all the brood. Now crowd the frame over the comb, so that the latter will be in the same position that it was when in the old hive; that is, the honey will be above; then fasten the comb in the frame, by winding about all one or two small wires or pieces of wrapping twine. To raise the frame and comb before fastening, raise the board beneath till the frame is vertical. Set this frame in the new hive, and proceed with the others in the same way till we have all the worker comb—that with small cells—fastened in. To secure the pieces, which we shall find abundant at the end, take thin pieces of wood, one-half inch wide and a trifle longer than the frame is deep, place these in pairs either side the comb, extending up and down, and enough to hold the pieces secure till the bees shall fasten them, and secure the strips by winding with small wire, just above and below the frame, or these may be tacked to the frame with small tacks. Having fastened all the worker comb that we can fasten into the frames, —of course all the other, and all bright drone comb, will be preserved for use as guide-comb,—and placed the frames in the new hive, we now place our hive on the swarming-board or sheet, with its front raised, and shake all the bees from the cluster, from the box which we set on the old stand, and any that may have clustered where we transferred the comb, in front just as before explained when describing the method of hiving in natural swarming. After the bees have all gone in, set the hive where the old one sat. In two or three days go and remove the wires or strings and sticks, when we shall find the combs all fastened and smoothed off, and the bees as busily engaged as though their present home had always been the seat of their labors.

SHALL WE CLIP THE QUEEN'S WING?

In the above operation, as in many other manipulations of the hive, we shall often gain sight of the queen, and can if we desire clip her wing, if she has met the drone, that in no case she shall lead the colony away to parts unknown. This does not injure the queen, as some have claimed. Yet if she essays to go with a swarm, and if the apiarist is not at hand, she will very likely be lost, never regaining the hive; but in this case the bees will be saved, as *they will* return to the hive. I always mean to be so watchful, keeping my hives shaded, giving ample room, and dividing or increasing, as to prevent natural swarming. But in lieu of such caution I see no objection, and would advise clipping the queen's wing.

ROBBING.

In transferring, extracting, and in various other labors of the apiary, especially if there is a dearth of honey secretion, we are apt to induce robbing. Black bees especially are very apt to rob, and to be robbed. Italians almost always, and always if strong, will defend their stores.

Should we find our bees robbing, we have only to contract the opening of the hive which is the scene of pillage, so that but one bee can pass at a time, to put a stop to all further trespass. But the thoughtful apiarist will never fear robbers, as his colonies will be so strong that it will be a sorry day for the "tramp" that attempts to gain an entrance.

BEE MOTH—GALLERIA CEREANA—FAB.

It might be expected that this enemy would receive attention at this time, and in such a treatise. Yet if Italian bees are kept, or if the bees are kept strong,

we need have no fears of this enemy. Yet even then caution as to handling and storing comb is requisite, and so I will speak of this enemy of the apiarist.

It is certain that larvæ, the so-called worms, chrysalids, or pupæ, and the fully matured moths, and possibly eggs, exist through the winter. In April and May, and even into June, the moths will come forth. Those which survive the winter appear first, then those which develop from the pupa, afterwards those which come from the larvæ, and, lastly, those which come from eggs, providing eggs are laid in autumn. These moths (Fig. 19) are gray, with a dark stripe on their backs, and while at rest their wings are folded roof-like on their backs. The female is the larger, and has the more projecting snout, more properly palpi. (These moths belong to the family of snout moths—*Pyralidæ*.) After pairing, the female lays her one or two hundred eggs, probably on the comb, though some think any where about the entrance of the hives, or along the bottom. In a week or two, depending on the temperature, these eggs hatch. The larva (Fig. 20), which is a dirty white with a brown head, constructs a silken gallery, which it extends as its growth and needs require, and in which it feeds upon the comb or wax, which serves it for food. In from three to five weeks it attains its full growth and changes to a chrysalis in a cocoon of dirty silk, which it has previously spun. In about two weeks the moth again comes forth, and prepares for a second brood. So, while I think there are really but two broods a season, still the moths may be seen during every month of the season from April to winter.

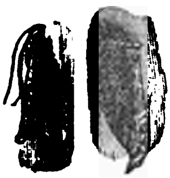

FIG. 19.

FIG. 20.

The moths are nocturnal, and are attracted both by lights and sweets. During the day they may be seen about the hive or store rooms, and though not concealed, are often quite unobserved, owing to their obscure colors.

The fact that frames and honey-boxes of comb removed from the hives of strong colonies to a secure place are often attacked by the larvæ, has led some to suppose that the eggs of the moth are laid about the hive, and carried, by adhering to the bees, to all parts. Unless an occasional moth steals in and plants her seeds of mischief, despite the most strong and wary colony, it would seem that this must be true.

REMEDIES.

Pay no heed to moth-proof hives. They are worse than useless. Make the hives well, so that there shall be no crevices in which the insects can pupate. But the sure preventive is to keep strong colonies, always possessed of queens; yea, of good, fertile, prolific queens, and no one need fear. As we have seen, this is the only wise course for many other reasons. Vessels of syrup placed about the hives at night will catch the moths.

Combs not in use should be kept in moth-proof boxes, closely watched, and if attacked, should be exposed to the fumes of burning sulphur. Honey-boxes containing honey, though not often disturbed, may need similar treatment.

OTHER ENEMIES.

The kingbird or bee-martin often preys upon both drones and neuters. Yet these birds are very valuable as insect-destroyers, and, so far as I have observed, never do sufficient harm to the apiarist to merit the death warrant.

The same may be said of the toads, which may often be seen sitting demurely at the entrance of the hives, and lapping up the full-laden bees with the light-

ning-like movement of their tongues, in a manner which can but be regarded with interest, even by him who suffers the loss. Mr. Moon, editor of the Bee-World, made this an objection to low hives; yet the advantages of such hives far more than compensate, and with the bottom-board, such as described in the chapter on hives, we shall find that the toads do us but very little damage.

In the south-west of our country, from Missouri to Texas, there is a large two-winged fly, belonging to the family Asilidæ, which does some mischief. Never having seen its evil work, I can suggest no remedy.

During the past season I also learned from various apiarists of a parasite, probably a tachina fly, that was preying upon the bees. It is to be hoped that this will give no serious anxiety. If it should become a troublesome pest, no doubt but a remedy will be discovered. Man's intelligence has always proved equal to his needs.

BEES-WAX.

Of course the prudent apiarist will desire that nothing be lost. So soiled drone comb, and *very old* worker comb, may and should be melted into wax. All other comb is far too valuable to be destroyed.

The best method to separate the wax is to put it into a strong, rather coarse bag, then sinking this in water and boiling. At intervals the comb in the bag should be pressed and stirred. The wax will collect on top of the water. If large quantities of wax are to be extracted, it is better to procure a wax extractor.

WORK FOR DIFFERENT MONTHS.

Though every live apiarist will take one, at least, of the four or five excellent journals relating to this art, printed in our country, in which the necessary work of each month will be detailed, yet it may be well to give some brief hints in this place.

JANUARY.

During this month the bees will need little attention. Should the bees in the cellar or depository become uneasy, which will not happen if the requisite precautions are taken, and there come a warm day, it were well to set them out on their summer stand, that they may enjoy a purifying flight. At night when all are again quiet return them to the cellar. While out I would clean the bottom boards, especially if there are many dead bees.

FEBRUARY.

No advice is necessary further than that given for January, though if the bees have a good fly in January, they will scarcely need attention in this month.

MARCH.

Bees should still be kept housed, and those outside still retain about them the packing of straw, shavings, etc. Frequent flights do no good, and wear out the bees. Colonies that are uneasy, and besmear their hives should be set out, and allowed a good flight and then returned.

The colony or colonies from which we desire to rear queens and drones, should now be fed, to stimulate breeding.

If from lack of care the previous autumn, any of our stocks are short of

stores, now is when it will be felt. In such cases feed either honey, sugar, or place candy on top of the frames beneath the quilt.

APRIL.

During this month the bees may all be set out. It will be best to feed all, and give all access to flour, when they will work at it, though usually they can get pollen as soon as they can fly out. Keep the brood chamber contracted so that the frames will all be covered, and cover warm above the bees to economize heat.

MAY.

Prepare nuclei to start extra queens. Feed sparingly till bloom appears. Give room for storing. Extract if necessary, and keep close watch, that you may anticipate and forestall any attempt to swarm. Now, too, is the best time to transfer.

JUNE.

Keep all colonies supplied with vigorous, prolific queens. Divide the colonies, as may be desired, especially enough to prevent attempts at swarming. Extract if necessary or best; adjust frames or boxes, if comb honey is desired, and be sure to keep all the white clover honey, in whatever form taken, separate from all other. Now is the best time to Italianize.

JULY.

The work of this month is about the same as that of June. Supersede all poor and feeble queens. Keep the bass-wood honey by itself, and remove boxes or frames as soon as full. Be sure that queens and workers have plenty of room to do their best, and suffer not the hot sun to strike the hives.

AUGUST.

Don't fail to supersede impotent queens. Between bass-wood and fall bloom it may pay to feed sparingly. Give plenty of room for queen and workers as fall storing commences.

SEPTEMBER.

Remove all surplus boxes and frames as soon as storing ceases, which usually occurs about the middle of this month; feed sparingly till the first of October. If robbing occurs, contract the entrance of the hive robbed. If it is desired to feed honey or sugar for winter, it should be done the last of this month.

OCTOBER.

Prepare colonies for winter. See that all have at least thirty pounds of good capped honey, and that all are strong in bees. Contract the entrance by using division board, and cover well with the quilt. Be sure that one or two central frames of comb contain many empty cells, and that all have a central hole through which the bees can go.

NOVEMBER.

Before the cold days come, remove the bees to the cellar or depository, or pack about those left out on the summer stands.

DECEMBER.

Now is the time to make hives, honey-boxes, etc., for the coming year. Also labels for hives. These may just contain the name of the colony, in which case the full record will be kept in a book; or the label may be made to contain a full register as to time of formation, age of queen, etc., etc.

I know from experience that any who heed all of the above may succeed in bee-keeping,—may win a double success: receive pleasure and make money. I feel sure that many experienced apiarists will find advice that it may pay to follow. It is probable that errors abound, and certain that much remains unsaid, for of all apiarists it is true that what they don't know is greatly in excess of what they do know.

REPORT ON THE APIARY.

AGRICULTURAL COLLEGE,
LANSING, MICHIGAN, Dec. 1, 1875.

To the President of the College:

The following is my report as Superintendent of the Apiary:

Three colonies of bees were placed in the new depository in November, 1874. These seemed perfectly well and healthy till the terribly severe weather of February, 1875, when as a result of the extreme and protracted cold, ice accumulated between the combs, and two of the best colonies died outright. The third colony only survived the winter, to perish early in spring. This proves that a house built above ground, with double walls around and above, one foot apart, and filled in with saw-dust or muck, is inadequate protection for a few colonies at least, during so severe a season as that of the winter of 1874–5. It is possible that a large number of colonies would have maintained a sufficiently high temperature.

In April I procured a colony of black bees in payment for transferring some bees for a neighbor. I also purchased two colonies of nearly pure Italians, of Mr. O. Fuller of Mason.

During the season I have prepared a number of places for stands, by digging out the earth to a depth of four inches, and for the space of four by six feet. I then paved this on the bottom with old brick, and filled up to the general level with saw-dust. This makes a smooth surface, so that there is little danger of losing the queen. The brick bottom will prevent the growth of weeds and grass. I prepared eight such places with student labor at a cost of $1.50. I have also made a moth tight box for holding frames of comb. It has a capacity for over 100 frames, and cost for material $1.33, for labor (students') $1.50. I have also built two hives with student labor at an expense of $2.00.

Pursuant to authority from the board granted at the August meeting, I have prepared a cellar under the bee-house. This has been done entirely by student labor, at an expense of $32.84. The cellar will contain over 50 colonies of bees, is thoroughly drained, and is grouted throughout within. It is hoped and expected that this will be frost-proof, entirely dry, and thus an admirable place in which to winter bees. In this we propose to keep our ten colonies for the winter. The bees were put in the cellar on the 26th of November.

The following is the account with the apiary for the year.

APIARY.	CR.	
By 55 5-6 lbs. honey (extra extracted) @ 20c	$11 17	
103 " " extracted @ 15c	15 45	
38 " " (comb) @ 25c	9 50	
Total cash receipts	$36 12	
By 32 lbs. honey (comb) on hand @ 25c	8 00	
6 colonies bees (increase) @ $6.00	36 00	
Total		$80 12

APIARY.	DR.	
To two colonies bees	$12 00	
one smoker	1 50	
express on honey extractor	1 00	
food for bees	7 60	
material and labor for honey box	2 83	
two hives @ $1.00	2 00	
15 hours' student labor, care of bees, @ 10c	1 50	
15 " " " improving grounds @ 10c	1 50	
lime $1.75, nails 12c, lumber 83c, and hinges 35c, for cellar	3 05	
students' labor for cellar	29 79	
Total		$62 77
By balance		$17 35
Amount expended for permanent improvements		54 17
Net profits on three colonies bees		$71 52

In the above estimate we have not included empty comb, worth at least $10.00, which we used during the season. This would reduce the profits to $61.52.

Our present stock in the apiary is as follows:

Ten colonies bees @ $6.00	$60 00
Three honey extractors	16 00
Tools, etc.	3 00
Honey box	2 83
Honey	8 00
Bee house	280 00
Total	$369 83

DONATIONS.

During the year, we have received a honey extractor of Mr. A. I. Root of Medina, Ohio, which from its exceeding lightness and durability seems all that can be desired. We have also received a large package of Long's comb foundations which entirely satisfy the bees, and bid fair to rank as improvements in apiculture with the movable frame, and the mel-extractor. Mr. John Davis of Delhi presented us with a fine colony of Italian bees from an imported queen.

SMOKER.

During the year we have purchased a Quinby smoker, which works admirably, and is a very desirable article for the apiarist to possess.

LAYING OUT GROUNDS.

This year, owing to a press of other work, and the cutting up of our grounds by the drive to the college, little has been done, except to set out some tulip trees on the apiary grounds. Next year it is expected that the grounds will be tastefully laid out, many more honey trees, shrubs, and annuals planted, and the whole apiary set in order.

STATE FAIR.

I took pains to exhibit at the State Fair such articles and inventions as I thought would interest and profit the bee-keepers. These articles were studied very closely, and were noticed at length in reports of the fair given by the press and by the committees.

EXPERIMENTS.

In constructing our bee-house last year, I filled in between the partitions half and half with perfectly dry saw-dust and muck, each substance filling half of each side. This fall, upon removing these substances, it was found that the boards next the saw-dust were little injured, while those next the muck were very badly decayed.

During the first two weeks of August there was a cessation of honey gathering for about two weeks, during which time half of our colonies were sparingly fed, while others were left without feeding. The difference in brood rearing, in favor of those fed, was very perceptible.

The first of October all our colonies were examined for the last time. All had brood, and all were contracted by means of division boards. Three of these had all their honey taken from them, and were fed during the first half of October sufficient coffee A. sugar to winter them. Three others were given nearly enough honey for winter, and sparingly fed with sugar for the same period as the above. The remaining colonies were given enough honey for winter, and have remained undisturbed. The object of these experiments is to determine whether sugar is preferable to honey as food, and whether late fall feeding, thus stimulating to late brood rearing, is any advantage.

One colony has been kept from rearing young bees since the first of August, while it was kept strong in old bees that we may determine whether late breeding is necessary.

A. J. COOK.

PRUNING APPLE TREES.

A PAPER READ AT THE FEBRUARY MEETING OF THE STATE POMOLOGICAL SOCIETY HELD IN LANSING, 1875.

BY PROFESSOR W. J. BEAL.

Pruning of apple trees has been practiced for more than two thousand years, yet to-day probably there is no one common operation in horticulture about which there is a greater diversity of opinion. There are many theories and systems. There are advocates for high tops and low tops, pruning in and pruning out, pruning up and pruning down; advocates for each season of the year as the best and only one suitable; and it is not strange, there are some advocates for no pruning at any time. Some would prune according to circumstances, some would bring all trees to one uniform rule. Thirty-five or forty years ago, Dr. Lindley gave to the world information on this subject which is far in advance of what most of our fruit-growers now practice.

Pruning, and the ignorance which still prevails on the subject, affords one of the best examples for showing the necessity of teaching the youth of our land, not only the reason *why*, but show them *how* to prune.

The agricultural press of our country has told over and over why, how, and when to prune, still only a small part of those who have orchards follow any good method. As we pass over the country a well pruned orchard is the rare exception. Unless the boys are brighter than usual, or unless they are thrown, at the proper age, under the guidance of a skillful person, they will do as did their fathers, good or bad, in pruning as in most other farm operations.

Most of us will agree that Dr. Lindley was right in saying: "If well directed, pruning is one of the most useful, and, if ill-directed, it is among the most mischievous operations that can take place upon a plant." It is safer and better to prune too little than too much. Trees as they come from the nursery are generally four years old and have four to eight branches about three feet from the ground. These all come out within a space of six or eight inches. The leader or main stem has been cut off. While small the branches look well enough, but if allowed to grow, when the tree becomes a foot in diameter they will appear to be all in a cluster. Such trees are very apt to split down, especially of some varieties like the golden russet and yellow bellflower. In some cases the trunk divides into two or three branches of about equal size. If there are two, one should be checked by cutting back or be removed entirely. Eight inches from center to center above each other (even if on different sides of the tree) is near enough for main branches, as they leave the trunk. The leader

was cut off to induce branches to come out and form the head. Another leader can be formed of a top branch. If it does not run up straight enough, tie it for a while to one nearly opposite. As the buds are arranged in a spiral (and branches too) on apple trees, if we call the lower branch number one, number five should be the next bud to make a leading branch of the head, numbers nine, thirteen and eighteen the next in order. This arrangement of buds brings them at an equal distance from each other around the main stem. If you do not like the branches to remain three feet from the ground, cut them back to three inches from the trunk, and after others are formed higher up, cut off the lower stumps entirely. The rule for altering the shape of a tree is this, "change gradually." From each of the main branches let but two buds grow. These again will soon divide and with a little care a nice symmetrical top may be formed.

Those favoring *low tops,* with branches three feet or less from the ground, want the trees low for protection of the tree from wind, because it is easier to pick the fruit; does not hurt it so much to fall; the tree bears sooner and better; they do not want to cultivate after a few years, at any rate near the tree.

Those favoring *high tops,* branches five feet or more from the ground, like the trees high to allow air to circulate under the limbs, to let the sun in to color fruit; to permit clean culture; it looks better; the fruit is better. Apples on limbs near the ground are not worth much. Of course I do not expect to settle this question. There are good reasons on both sides. Good apples will grow on the lower limbs, and the lower limbs will not die, if the upper limbs are kept thin enough. The best roots of a tree are under the ends of its broad limbs, or further out. That is the place where culture will produce most effect. If clean culture is an advantage, as it may be, in keeping off the codling moth, then all other reasons for low tops will be of minor importance. In that case we should all prune high to make clean culture easy close to the tree. Many a man who started his trees low has changed his views, and has afterwards pruned up by cutting off large limbs. If an orchard is to be pruned only once in two or six years, as many do prune, it is better to start the trees high. If started low and left for a few years, the lower limbs will be smothered, die out, and thus be of great damage to the tree. Large lower limbs are less likely to die in a high tree than in a low one.

WHY PRUNE.

It is almost universally conceded as best to cut off some of the top when transplanting an apple tree. Many of the roots are taken off, so we take off some of the top to prevent too great a stock of leaves, which shall call for more sap than the roots can furnish. We prune a tree to keep the top well balanced; symmetrical; to prevent the limbs from crowding and starving each other; to keep strong all the limbs which are left. One object in pruning some trees, as the Spy, is to make them broader by cutting just above a bud which is on the outside of a branch; in others, as the Talman Sweet, by a reverse practice to make the top narrower. We may also prune to produce or to check fruitfulness.

WHEN TO PRUNE.

Occasional small limbs may be taken off at any time when the tree is not frozen. A general trimming of quite a number of limbs may be made after the fall of the leaf until the buds begin to open in spring. All things considered, I think spring is the best time for a general pruning. Fortunately, this

46

is the time when most people are likely to attend to it. A wound made by sawing a large limb will heal quickest if cut in June, but rapid healing is not the only thing to be considered. It is a serious objection to heavy pruning,—that it checks the growth if done while growing rapidly. "Water sprouts" and suckers should be rubbed off, while tender, two or three times during the season. In fact, if all pruning were done in this way, it would be better for the tree. But few men will attend to it. The present price of fruit may not warrant it. If a tree has been improperly pruned or neglected while young (and nearly all of them have) the crotches, which are in danger of splitting down, may be tied together by grafting two limbs, which may serve as a mutual tie. My rule is, even with trees in bad shape, not to cut off a limb over an inch in diameter. If those larger are dead, or if you think they must come off, saw them close and paint the wood as soon as dry. Avoid leaving stubs which will die and make an ugly weak spot in the tree. A smooth draw cut with a sharp knife is best. To direct several hands in prunning, give them all a talk before beginning, and then go ahead and show them how. After a little start, you can mark with a crayon some of the largest limbs just where you want them taken off. This is not the time and place to give any directions about pruning to a wall, as it is often done in Great Britain. That is desirable in their climate with mild winters and cool summers, but in our country of great extremes, such pruning is never desirable. Trees so pruned in Michigan would be worse off summer and winter, than when pruned in the usual ways.

Root pruning is sometimes resorted to, to promote fruitfulness, but unless done in a careful manner, it is better not attempted.

HOW TOO OFTEN DONE.

Perhaps once or twice in the life of an orchard, the owner goes in, or more often he employs a *professional pruner* to attack his orchard. He uses ladders, and axes, and hand saws, and sometimes a paint dish and perhaps a jack-knife. He often cuts out half the top by taking off large limbs and trimming all the small ones on the lower part of the main branches. He chops and saws without mercy or judgment. He prunes up and out, leaving a lot of bushes at the ends of the remaining limbs. In this way he makes a great show with a little labor. He lets in the light, and thinks he has made a great improvement.

Sometimes the soil is not very good, the orchard becomes closely covered with turf; the trees do not grow nor bear much; they are covered with moss and infested with insects. The owner instead of going at the root of the matter and working a reform in the soil, cuts off half the tops of his trees to make the other half bear. Some young wood grows to take the place of the old, and on this grow a few apples, but the trees soon succumb to the hard fare they have received. I show here (in the lecture) an illustration of one of those three story trees, trimmed almost to death. It is an old veteran, bushy at the top and covered with scars. I saw the orchard in the Genesee Valley from which I presume Mr. J. J. Thomas took the cut for his Fruit Culturist. Similar trees are not hard to find in any of the older parts of our State. I have seen them in Monroe, in Lenawee, and I know of some not over half a mile away from Lansing (the Agricultural College is three).

SUMMARY.

There are advocates of all kinds of pruning and at all seasons of the year.
It is important that the boys have a good example.

Better prune too little than too much.

Keep a central stem from which branches are allowed to remain about six inches apart, and thus avoid bad crotches, which are liable to split down.

Thin out from the ends, some as a barber thins hair.

Keep the top thin enough to prevent large limbs from dying on account of shade. Cut limbs off close, but none larger than an inch in diameter.

Better cut off two or three or more small branches from a limb than to take the large limb itself.

Prune when not frozen or growing, except pinching or rubbing new growth in summer.

To change the height and shape of a tree, begin while the tree is young, and make the change gradually.

The lower limbs will do well if not shaded by too many above them.

Too many prune in a wretched manner, worse than none at all.

Our own State is not entirely free from bad pruning.

COMMON ROADS OF MICHIGAN.

BY R. C. CARPENTER, C. E. OF THE STATE AGRICULTURAL COLLEGE

The importance of good roads seems in many cases to be entirely disregarded, but it must certainly appear upon investigation that poor roads not only add to the people's inconvenience, but actually are an enormous tax on the traveling public. For instance, over a rough sandy road there can be drawn but from one-half to two-thirds of the load that could be taken over the same road if covered with a good, firm, and even surface of broken stone or gravel. Now, if the load is diminished one-half, one-third, or any known proportion, and the amount of traffic known, the exact determination of this tax becomes a problem of no great complexity. Suppose, as is frequently the case, that 20 loaded teams pass each day over a portion of road 20 miles in length, which is in such a condition as to reduce the load to two-thirds of what could have been taken over a good road, there is a waste each day by each man and team of one-third of a day's work, and for the 20 teams for a whole year of 300 days, this amounts to 2,000 days' work of a man, team, and wagon, which at the usual price of $3 per day would foot up to the sum of $6,000. In addition to this we will have a bill for extra wear to wagons and teams, so that in all probability the total expense would be at least one-third greater, or $8,000, which is about $400 per year for each mile of road.

These figures may look large, and it may be thought that such *poor* roads in our State are comparatively rare; but I am of the opinion that few roads in our State are even as good as the one considered. There are very few roads over which a single team can keep a steady pace for 8 hours in the 24 and draw 30 bushels, or 1,800 pounds, of wheat on a wagon weighing 900 or 1,200 pounds, making in all a load not exceeding 3,000 pounds. On a good road the amount drawn by a team should be double this at least; for it has been found by experiment that an average team of horses will exert from 240 to 300 pounds of tension steadily for eight hours per day; and it has been further found that the resistance on a *good* road of broken stone or gravel is 1-30th the gross load; consequently one pound of tension should draw a weight of 30 pounds, and a team should pull with ordinary exertion 30 times 240 pounds, or 7,200 pounds.

This result, though seemingly large, is more than realized on the English roads. C. Herschel states that it is a patent, undeniable fact that the English horse employed in the streets of a city or on the roads of the country does twice as much work as the American horse similarly employed in America. He further states that the English horse is no better than the American, nor is he worked any harder. The explanation is found in the fact that the Englishman

has invested in permanent roads what the American expends in perishable horses that require to be fed.

Such being the case, our poor roads are seen to be expensive not only in requiring more time, but also in requiring twice as many horses as would be necessary to transport the same traffic in the same time. Because of the lack of statistics regarding roads it is hard to make any estimate which shall convey in dollars and cents an idea of the exact amount our delinquency in this direction costs us; but this much is certain: that the amount tolled from us by the loss of time and by extra wear and tear is an enormous rate of interest on the cost of putting our roads into a first-class condition, and in most counties is a ten per interest on the adjoining lands.

In addition to all this, poor roads exert a detrimental effect on the intellectual progress of a people, for which deterioration we have no adequate standard in dollars and cents. Good roads form means of easy communication, lead to frequent social intercourse, and "pave" the way to a high intellectual development.

Farther, the value of an estate increases as the means of communication are improved. Examples of this are familiar to all. Distance is not of so much importance as time, and the place which is two hours' drive from market is equally valuable whether it be twenty miles or six miles away.

If good roads, then, are of so much importance, and poor roads the occasion of so much expense, the expediency of preparing better roads cannot be doubted; but a question will arise regarding the benefit derived from the amount that is now annually expended on our roads. The amount usually expended on roads varies from five to twenty per cent of the whole tax; yet all will admit, at least in the older portions of our State, that the roads are no better to-day than they were ten years ago, and in some portions of the state are not so good. Between this college and the city of Lansing to-day there is scarcely a stretch of road fifteen rods in length but what contains "pitch"-holes, through which a person must drive slow or endanger the safety of both vehicle and life; and in one place the refuse of a brick-yard has been regularly drawn and deposited in unconnected piles, one load at a time, turning a naturally level road into alternate hummocks and holes, which latter are filled with mud in wet weather and are very dangerous in dry weather.

Another example we take from the Detroit Free Press of September 2, 1875. A complaint was made by the citizens of Detroit against the Grand River plank road company, for keeping their road so poorly graded and so poorly planked that it was almost impossible to drive a horse along the highway at trotting gait without damage to both horse and vehicle. The people appointed a committee, who met Mr. Buhl and ex-Gov. Baldwin as representatives of the plank road company. Gov. Baldwin said he had lately taken a ride over the road, carefully noting its condition, and was surprised to find it so bad, but that he did not think it was as bad as had been asserted. However, he considered it dangerous to drive over in the day-time, and certainly would not think of going over it at night; and he promised to do all in his power to better the road. In the same article we learn that this is at present the best equipped, and is in the best repair of any plank road in the State, and that the above transaction applies only to the ten miles nearest the city of Detroit. Though the management of this road is in no way connected with the management of our highways, yet as this road is much better than many of its cross-roads in the vicinity of Detroit, it serves to show what a low degree of perfection we have reached in the art of road-making.

In the history of our State our roads in general improve until they reach a certain point, when improvement seems to stop, and they either remain in no better condition or commence a process of deterioration. The amount expended is sufficient to keep our roads constantly improving; but when we find they do not improve we are forced to believe that there are

ERRORS IN OUR ROAD SYSTEM.

Throughout our State, excepting perhaps the cities, the feudal system of paying the road tax by labor is in force. This system is attended with many evils, and has so far as I can learn been universally unproductive of good results. Most European countries have now abandoned this system, and have found that a very much lighter tax paid in money will give better roads. The evils which prevent any degree of perfection attending the workings of this system will generally be found to be: 1, Lack of a well developed plan of work; 2, Lack of capable superintendents; and 3, Lack of interest in the workmen.

The details of the system now in force in this State, and to which it will be shown that all these objections apply, may be summed up as follows: The general superintendency of the highways and bridges is given in each township to the commissioner of highways, who is elected by ballot for one year, and whose duties consist in the proper subdivision of his township into districts and the general direction of the work. He may be fined for any deficiency occasioned by his neglect of duty. At each town meeting an overseer for each road district is chosen *viva voce,* whose duty is to take immediate charge of the work in his district and see that each inhabitant discharges his road tax as provided by law; he is also liable to a fine for any neglect of duty.

The errors of this system are best shown by its practical workings. The want of a general plan is seen in the lack of continuity of effort, and is shown by the fact that a little is generally done in one portion of the district one year and in some other portion the next year, while underlying this is no scheme for general improvement, and no ambition to improve the road above a certain point. The lack of capable superintendents is patent to everybody. The building of roads is a life study, and a person who makes this a life business expects and is worth a good salary. The men who have generally filled the position of commissioner have known little about their work, and apparently have cared still less; and the small compensation they receive has been adequate pay for their services, for under their management our roads have had no tendency towards a better condition. One would naturally suppose that no want of interest could pervade the men on a work so important to themselves as this; but the well-known fact is, that in most parts of the country labor on the road is regarded as wasted effort, and each acts as though striving with his neighbor to see who could do the least amount of work; and it is seldom that a man is found willing to do the honest amount required of him by law.

TO GET BETTER ROADS

it is evident that we must adopt some system which shall be free from these striking defects, or else make some radical change in the management of the present system. There are many reasons to lead us to infer that our roads would be improved very much, and their actual cost would be no greater, if the feudal system of working our roads were replaced by one under the supervision of a competent man, in which the road tax should be paid in money and the work done to a certain extent by contract. The amount of work done per mile

in different districts will be found to vary from twenty-five to fifty days per mile. In the older and richer portions of our State the road work will in most cases be found to vary but little from forty days for each mile of road. This at the usual price of $1.50 per day would make the road tax amount to $60 per mile.

The town of Waltham, Mass., has long been noted for its good roads. The system in force there is substantially as follows: The town of Waltham employs a road superintendent and engineer, at a salary of $900 per year, and ten or fifteen men, one of whom has been thus employed for twenty years. The condition of roads in the town of Waltham and the adjoining town of Newton, is shown by report of committee from the latter town in 1869.

The town of Newton being under the old system of working out the road tax, we take the following from that report: "Your committee visited Waltham and found the broken-stone road there dry and hard. It will sustain loads of six tons without being cut into ruts. Returning, we observed the instant of passing from town to town in the changed character of the road. The first required scarce any mending, the last was cut up with ruts and full of mud, and workmen were dumping gravel four to six inches deep upon it. On the Waltham road it required not more than twenty pounds to draw the weight of the load, while on the main road of the rich old town of Newton it required one hundred pounds in tractive force."

The town of Waltham in 1865 contained 51 miles of road on which for the past seven years there has been an average expenditure of $66 per mile. In 1868 the town expended in repairs and moving of snow $117 per mile, while the adjacent town of Newton expended on her roads in the same interval $179.30 per mile. The reason for all this difference in cost is probably found in the old adage "that a stitch in time saves nine." A few shovelfuls of broken stone or gravel supplied to a rut when first it commences to form will accomplish a better result than as many loads applied six months later.

The experience of Waltham bears out that of Baden and France, conclusively proving that it is a matter of economy to the treasury to have a system of well built roads which are constantly watched by a few men who mend defects as they appear, instead of allowing the wear to make the roads almost impassable, and then employ a large force to put them in good shape. The objection of introducing such a system into Michigan is that the road tax must be paid in money. This difficulty I think could entirely be obviated by providing that all who wish should be allowed to work a sufficient number of days to liquidate this tax, subject to the direction of the contractor or town superintendent.

Instead of the system above described, I would like to see a more extensive system, having at its head a State engineer of highways, with as many assistants in charge of districts as he may need. In charge of these district engineers, and directly responsible to them, I would have the aforementioned township superintendents.

Such a general system would not only secure for us more uniform roads, but would afford means for economy of construction or repairs, that a single township or county is wholly inadequate to supply. Our railroads furnish the exact number of passengers and the amount and character of the freight transported, together with the cost and profits therefrom. On the other hand, the more important common roads give no report; we have no *exact* method of telling the amount of travel over any of our public highways, and all information respecting them is vague and unsatisfactory. Such is the difference between a general system and no system, that despite the high salaries of railroad officials

they furnish all means of transportation cheaper than the public prepares a way over which you must do your own transportation.

But even our present road system could be made to accomplish a great deal more good, by providing local means which would tend to check the action of its detrimental characteristics, which are different in diverse localities and with different people. For instance, a general discussion of the methods of improving our common roads will do not a little toward exciting an interest in the road work and stimulating a spirit of improvement; and it is to be hoped that all gatherings for the advancement of agriculture will give the serious consideration to common roads which their importance demands.

Until a spirit of improvement respecting roads is aroused and a desire for better roads is felt, it is but lost labor to give detailed statements of the methods of improving our roads. But the advantages arising from good roads are already beginning to be fully appreciated in this State, and influential men are seeking a solution of the problem that prevents us attaining a system of excellence with our roads. Questions regarding the best kind of road material, road drainage, grades, and method of procedure are continually arising, and in a future article an attempt to satisfy these demands will be made.

MICHIGAN STATE AGRICULTURAL COLLEGE,
Lansing, November, 1875.

PRACTICAL HINTS IN FLORAL ADORNMENT.

READ BY CHARLES W. GARFIELD BEFORE THE ADRIAN FARMERS' CLUB, FEBRUARY 22, 1876.

It is with some misgivings that I come before a matter-of-fact Farmers' Club, the discussions of which, as I have read them from time to time, are characterized by good, practical, sensible ideas upon farm and dairy management, care of stock, arrangement of farm buildings and kindred topics, with an address upon a subject that flavors so strongly of the ornamental. But when I consider how little of home adornment finds its way into the deliberations of our agricultural meetings, and how largely the happiness of our lives depends upon practical taste in the embellishment of home and its surroundings, I am glad of this opportunity to present a few thoughts upon a topic that lies close to my heart, the careful consideration of which brings light into the loneliest hours, and gives food to a part of our nature that is too often neglected, because it is not willing to sacrifice every thing upon the altar of the almighty dollar.

However philosophers may attempt to account for it, however they may theorize and speculate about the matter, the fact remains patent that all in greater or less degree enjoy beautiful things. This is noticeable in infancy and old age, and in the savage as well as civilized man. The babe in its mother's arms reaches eagerly for the lighted taper or the bit of scarlet ribbon, and is never so delighted as when presented with a rich color or delicate form. Since we find this element of appreciation implanted in man everywhere, unless we give it scope, opportunity for growth and material to feed upon, we say in as plain a language as words, that we doubt the wisdom of the Divine author in planting within us so characteristic a quality, and the propriety of placing in this world so many objects that seem to serve no higher office than to satisfy in us the desire to see, and hear, and make beautiful things.

Yet many people seem to have so lost all relish for these things, in which they once took the greatest delight,—to have become so materialized as no longer to find any pleasure in them. Some even appear to think it a wicked waste of time to cultivate flowers, and adorn their premises with shrubs and trees, or to show any taste in the construction of their houses, and in the arrangement of their gardens and fields. They have risen above such things,—have become men and put away childish matters; never seeming to think that, perchance, these were the very things designed to help make them purer and better men and women, preparing them for a higher influence, and thus make them more profitable workers in the field of the Master.

As a prefatory remark to immediately precede my practical remarks upon

arrangement of flowers I have no hesitancy in saying that home is not a *home* without flowers,—they teach us so much of love and trust as they blossom about the door or develop in our windows. I care not how lowly the home may be, if flowers are there we may rest assured that love sits by the hearth. The blossoms may fade but not until they have taught their lesson of love.

I am aware there is danger in the pathway I am about to tread, for our self-love will allow opinion to be trampled into the dust, and perhaps not murmur, but in matters of taste a crossing of our views quickly induces an individuality not easily suppressed or oppressed. But in the employment of color and form in the ornamentation of our surroundings, there are certain rules upon which all may unite, and their application to displays of flowers is perfect.

White light from the sun has for its component parts three colors: Red, yellow, and blue; these are known as primaries. Combining red with yellow, we form orange; yellow with blue we make green; red with blue we make violet. These three resultant colors are known as secondaries.

It will be readily seen that if one of the secondaries be put with the primary that does not enter into its composition, white will be the result. These colors, hence, are said to be complementary to each other because they make or complete white.

Now, as in music, those sounds best accord which are farthest from each other in the octave; so in color we have the most perfect harmony between the hues that are the most distinct from one another.

To illustrate the position these colors hold to one another, take a piece of blank paper and draw two circles, the one within the other, and much smaller. Divide each circle by dots into three equal parts arranging so the points in one circle will alternate with those in the other. Now, paint the primaries in the lesser circle at the position of the dots, and each secondary at that dot in the greater circle which alternates with the two primaries that compose it; the result will be that the complementary colors stand opposite one another at the greatest distance apart.

A queer fact connected with these colors is, that the eye when placed upon one, in a little while seems to tire of it, and if the gaze be diverted to a white wall, strange to say its complement will appear quite distinctly before us. A strong illustration of this truth is obtained by looking for a minute through a glass, for instance a green spectacle glass, and after looking through it for a short time remove it from the eye, when every object will seem at once transformed to a ruddy appearance, red being the complement of green. From this truth we gather another, that in our circles the colors most nearly diametrically opposed are complementary and enhance each other's brilliancy. Men who deal in dry goods employ this principle in the display of their goods, and florists do not hesitate to take advantage of it in the arrangement of their bouquets. Still, in most cases, they are entirely unaware of the general law, or the breadth of its application.

Turn for a moment to forms. Here we find no general principle that governs their influence upon the mind; still a doctrine in taste seems quite universal.

There is no particular beauty in a straight line or an angle, but easy curves are lines of beauty, and are everywhere admired, unless there is a gross violation of utility. A handsome face attracts our observation often simply because of its pleasing curves which flow into one another with the utmost delicacy. Sudden transitions are to be avoided whether in the curves of a drive, a flower bor-

der, or a floral design. I apprehend we give too little credit to the influence of form, upon our conception of beauty. Yet, if we think a moment, we can all appreciate how colors may be arranged never so deftly and their whole effect lost by an indelicate form.

We speak of a certain woman as being beautiful, yet we know the beauty is wonderfully enhanced by appropriate adornment. It is just as true of a flower. Its intrinsic beauty is never so great as not to be modified for the better by dressing it up. What is this camellia without its cup of leaves, and what an added beauty there is when we couple with a rose a spray of its own delicate leaves. The appropriate arrangement of cut flowers in the vase, bouquet, basket or design requires the most delicate apprehension of discord, as well as complete harmony; this taste, although it is largely the result of cultivation, must have a live germ to begin with.

The little girl of light complexion and sandy hair whom I have seen hunting for a scrap of blue ribbon to adorn her head, with ordinary opportunities will be an adept at arranging flowers. She knows the meaning of congruity before she can spell the word. Let us make a little application of our rules in regard to color. Here are a lot of cut flowers before us. We take first this brilliant carnation, varying but little from a pure red, it is beautiful by itself,—rather stiff and formal to be sure,—but very attractive withal; place beside it this white sister,—arn't they fine? I do not know that either is benefited by the other, but there is no discord, and of course two beautiful things must be better than one. But wait a moment; here is a geranium leaf, nothing very wonderful about that,—thousands of leaves more delicate by far,—place it back of our carnations, mark the effect. They were beautiful before, now they are incomparable. Why this wonderful effect? All explained in a single sentence: green and red are complementary colors, and together form a very effective "mutual admiration society." We will place this combination in our tiny vase. Yes, it is truly beautiful, but still something grates harshly. It is top-heavy,—too large for the vase; it looks stiff, uncompromising, altogether too "big-headed." Substitute this sprig of scarlet and white bouvardia, with a delicate leaf for the background. That is better. The discord was due to incongruity of form. Carelessly twine this spray of smilax about the base and we have added 50 per cent. It is complete. Again, take this purple cineraria, place it along with scarlet, with red or with blue and it makes a sorry appearance. It is really a rich color in itself. But look carefully at its center and you will observe the beauty of the flower is indebted largely to those bits of polen which have burst from the anthers and still adhere to the blossom. We have really found a place for the brazen jasmine (a flower with no pretensions to beauty, and would never have entered the dreams of the poets without its odor), not so attractive a combination, to be sure, as our first arrangement, but not altogether unpleasing, and with a bit of white is not so far inferior to the bouvardia combination.

With a piece of paper stretched across a box, and perforated with holes, we can form all sorts of combinations and accumulate an indefinite amount of evidence in verification of the statement that the law of complementary colors should always govern floral decorations. But you will say many times, our flowers are limited and we cannot accord with this rule. I have only to answer to this: white, the unit of all color, comes to the rescue. It is not out of character in any company. It smiles upon crimson as well as upon scarlet, and placed between them dissipates the frowns they always hold in readiness for one another, in case of too great intimacy.

Generally speaking, colors that are closely allied injure one another, and need to be separated with white. However, this statement requires modification when we have several shades or tints of a given hue that vary about equally. The regular gradation has in it no element of discord. Let me diverge a little, and give a few definitions of words very commonly misapplied. A *tint* of any color is that color mixed with white; a *shade* is made by admixture of black. Tints and shades are graded very delicately in some plants, and make pleasing combinations.

The reason why green is so easily and appropriately combined with most flowers is that our finest flowers are of the shades and tints of warm colors, red, yellow, orange, scarlet, etc. Green being a cold color complements them, and forms a handsome contrast. The fault into which one most easily falls is the bunching of too many flowers together. A bunch of flowers or a clump of trees is scarcely endurable to good taste, and never attractive,

Our first desire in a close bouquet, is to remove one of the most beautiful single specimens and enjoy it alone. This is the reason why open vases of cut flowers are indefinitely superior to close florist's bouquets.

What is a carnation worth in a bouquet when the calyx is entirely hidden, or this primrose without its base of delicate green? Nature has usually arranged colors very deftly, and when we try to supersede her, there is liability of unprofitable errors. How often we see bouquets worth a dollar made of rare tea roses, where there is really less beauty than in one of our tiny vases containing but a brace of flowers and a green leaf. Still people will come to our greenhouse, and desire bouquets with "lots of flowers." When a lady visits us and orders a bouquet of flowers from our College greenhouse, I always feel sorry for her because she really is losing so much pleasure in arranging the flowers. The amount of flowers employed in making a single table bouquet, would in the hands of a tasty person furnish a delightful floral display for a suite of rooms, and remain fresh far longer than wrapped in the confining cord. Flowers for a dinner table may be preserved several days with their original fresh appearance if placed in a vase or dish upon a plate with a little water in it and a bell glass covered over and setting in the water, thus stopping evaporation. I have preserved a few Chinese primroses two weeks under a large wine glass placed in the same manner acting the part of a bell glass. Every body that likes flowers enjoys gathering wild flowers in the meadow and woodland and yet how rarely we see the result of these excursions in any arrangement of taste. They are universally in a cumbersome bunch—only calculated to excite the ridicule of any one who appreciates pleasing combinations and apt contrasts. The errors of association become most flagrant where flowers in gardens and woods are most abundant. It is far safer to group decided colors in separate vases than risk ill suited combinations by crowding too great a display into a small compass. Strong colors permit the employment of a good deal of foliage and many beautiful flowers and plants are crippled by taking from them their natural habit. A drooping flower or trailing stem should be indulged in its tendency when plucked from the plant, and the individuality of many flowers is entirely neutralized often by shortening the stem to make it bow to some formal plan.

Flowers should be suited to their surroundings. In a dark room richly furnished white flowers can scarcely be admitted with taste, while brilliant, strong colors are quite in accord. In contrast with this we always place white flowers with delicate flowing foliage in a room where sunlight has ready access. I can scarcely say where a stiff bouquet of the florist's most formal pattern can be

appropriate, unless in the hand of a piece of statuary or that which approximates to it in life, and is slurringly denominated a wall ornament at our social evening entertainments. After all, the most delicate arrangement of floral designs employed for dining room decorations, none are equal to a nicely grown plant in full bloom. The effect is just enchanting, and now that extension tables are so commonly in use, a pot plant can very easily be arranged with the unsightly part beneath the cover while the table above will be ornate with the delicate foliage, pleasing habit and brilliant floral display of the well selected plant. I need not detail the way to arrange for this; any lady can overcome all the difficulties of preparation and secure this inimitable style of table decoration.

In the planning of flower beds out of doors we find the same rules of taste modified somewhat to accord with external associations governing their arrangement. The three features to be kept in view are height and habit of plants, color and duration of flowers and season of bloom. Further, it is well to remember that beauty is depreciated by every sacrifice of utility, interest or unity of design.

Many persons think to make a natural rather than an artificial appearing garden by having every thing mixed. This is a manifest error. We look for neatness and some thing of formality in the flower borders. If we can secure this end by covering to some extent the means employed, so much the better. In dress we look for subdued shades and strive to secure such combinations that one color will moderate its neighbor, but in the flower garden the reverse is true. Colors and forms should be so employed as to strengthen and heighten one another. In a plantation of bedding plants the form of bed or border first requires attention. Round, elliptical, oval or oblong beds are most largely made, but I think oftentimes there is an added beauty in having the beds so cut as to produce miniature vistas among the plants. When borders are cut in sod upon the sides of a drive or walk, a good balance should be maintained without the display of an attempt to be symmetrical. The effect in large measure depends upon proper arrangements of tones and hues of color. In a circular bed having a central plant with five surrounding it, the following are simple, effective styles:

1. White center, supported by scarlet, blue, orange, rose and purple.
2. Yellow center, supported by purple, pink, blue, white and red.

In beds where zones of colors are employed, if cut in sod, always close with a warm color next to the green turf; and if upon gravel, let the outer circle be of a cold hue. The plan of massing colors in borders is very popular and tasty; and in this connection allow me to say there is no contrast as effective as that made by placing a mass of perennial phlox so that it shall have a background of dark evergreen foliage.

A word more about form. In criticising flower beds for the past two seasons, —and very many came under my observation,—I found there was altogether too little attention given to the habit of the plants. No matter if the arrangement of the colors be unexceptionable, a straggling habit of two or three plants entirely destroys the good effect of the whole. Plants should be well under control, and never more than six inches in height at their maximum in a bed eighteen inches wide, nor increase more than six inches for every added foot in breadth. There should always be an easy transition from one zone to another, and thus secure a pleasing outline. If you employ a plant of drooping habit for the center, strive to make the bed a unit in this respect and above all things

avoid violent transitions or striking contrasts in form. It is the height of incongruity of form to place a coarse leaved, straggling plant, like the coarser geraniums, with the delicate foliage of another like the finer acacias. It requires a long experience to detect the breaches of good taste in floral displays, and it is true that those who have the best theoretical knowledge are not always the least deficient in details.

The cultivation of flowers is adapted to rich and poor, to the educated and the illiterate, and there is a refinement growing out of this close relationship that is felt outside the poetical measures; a reality of culture not to be lost by jostling against the hard rough world. There is a moral and religious atmosphere about flowers that has been appreciated ever since the adornment of Eden. The pagans understand this, and dedicate their richest floral offerings to the Gods. Christians comprehend it, and deck their pulpits with the most appropriate of Flora's treasures.

Painting and sculpture have their appropriate place and influence, but their potency lacks the universality of Flora's gifts. We love flowers, we pet them, they grow into our hearts and develop in us a higher love for purity and goodness; they bring to us precious memories of the past, suggesting bright promises and fond hopes, kind words and pure hearts. We find in their growth and development, evidences of God's being, strong enough to convert the worst of infidels. Does it not behoove us as lovers of morality and believers in christianity to cherish and develop this love of floral treasures when we know the world is so largely indebted to it for the refinement that characterizes our most advanced civilization. Our Saviour appreciated the influence of floral studies and the power of natural perfection and beauty of the floral kingdom over men, and with what emotional pathos he must have pronounced that memorable expression, "Consider the lilies of the field how they grow; they toil not, neither do they spin, and yet I say unto you that Solomon in all his glory was not arrayed like one of these." Christ loved flowers; let us love and cherish them, and employ them in our homes, in our churches, in our public places, in our hearts for the encouragement of pure thoughts and desires, and for a development of that higher emotion which leads us to look from nature up to nature's God.

CARNIVOROUS PLANTS.*

BY PROFESSOR W. J. BEAL.

This is a new term which has been lately applied to plants that catch insects by various contrivances.

In 1768, over 100 years ago, Mr. Ellis discovered that the Venus' fly trap of North Carolina catches insects by a peculiar construction of the tips of its leaves, some like a steel trap. Numerous experiments have satisfied most botanists that flies are not only caught, but digested by a fluid poured out by the plant, and the materials absorbed into the tissues of the plant.

In 1780, 95 years ago, the sun dew (*Drosera*) was found to catch insects by its sensitive hairs, with a sticky gland at the end of each. *Drosera rotundifolia*, a common little plant of our marshes, has a round leaf about the size of a cent, and sometimes catches as many as eighteen small flies. The glandular hairs move towards the fly when irritated. *Drosera longifolia* has a very long slender leaf also covered with glandular hairs. It rapidly coils up from the tip, catching flies, which it devours and absorbs.

North America has eight species of pitcher plants, the leaves of which catch insects. They have stiff hairs inside pointing downward, which prevent the escape of most insects. Some have a sweet secretion below the opening at the top on the outside. This grows sweeter and more abundant till it comes to the opening to entice foolish flies to the fatal pit, whence flies are not likely to return.

Catesby, some years ago, thought these pitchers were an asylum for insects to escape from frogs and other animals.

I have here some fresh specimens of *Sarracerniá purpurea*, the only pitcher plant found in our State. Pouchet, in his popular book, "The Universe," speaking of this plant says: "The leaves rise from spot to spot at the feet of the traveler, and are filled with pure and delicious water, for the benefit of which he is all the more grateful, that he is encircled by nothing but marshes." This is the fancy. The truth is the water abounds in rotten bugs and worms.

There are some thirty species of *Nepenthes*, most of which secrete honey on some parts of their pitchers, to entice insects, which they catch and devour.

The spathe of *Alocasia* catches slugs and destroys them in a strong secretion.

For a full account of the above interesting plants, see Dr. J. W. Hooker's inaugural address last year, at the British Association, printed in Nature, Vol. 10, p. 366.

Pinguicola catches insects.

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*This is a paper read in Detroit, at a meeting of the Association for the advancement of Science, held August, 1875.

According to Mrs. Treat, bladderworts (*Utricularia*) catch infusoria and other small animals. These are taken by strange devices in the little bladders, which work some like miniature eel traps. The animals are digested and contents absorbed by the plant.

In addition to the above, we have quite a large number of other plants, belonging to diverse natural orders, which catch insects. The young leaves and stems of the *Rhododendron* is one of them.

A species of *Plumbago* in the green-house, sent from the Agricultural Department at Washington, has viscid hairs about the flowers large enough to catch and hold a common house fly, even if caught by one or two legs. *Robinia hispida* is another familiar example. Several species of *Polanisia, Cuphea viscora, Saxifraga, Pelargonium, Primula, Robinia,* some species of *Physalis,* and *Solanum* catch small insects by sticky hairs on the younger portions of the plant. Many species of *Silene* attract, catch, and hold insects to such an extent that the genus goes by the popular name of "catch-fly." *Lychnis Vespertina,* a kind of cockle sometimes in our wheat-fields, also takes small insects. It seems to digest them by the small glands at the end of the hairs. We need not necessarily suppose that they are digested because they are captured by sticky plants.

The large bud scales of the horse chestnut and balsam poplar in the spring of the year are often found holding insects by the sticky varnish with which the buds are very copiously covered. We see that the varnish may be of use to protect the inner delicate parts of the bud from the inclement weather, but I am unable to see that insects are of any advantage to the plant when so caught. The dry bud scales are sticky for a purpose which we can readily understand. On bud scales the flies are most likely accidentally caught. Possibly this is the case with some other plants which catch insects by a sticky secretion or other contrivance.

I have lately given some attention to the great numbers of small *diptera* (flies, gnats, etc.) which are caught by the glandular hairs of the *Martynia* of our vegetable gardens. On August third I counted 76 small diptera (mostly flies) on the upper side of a young leaf of about four inches average diameter, and over 200 on the under side. Flies, beetles, plant lice, etc., are caught on all parts of the plant which are exposed; on the stems, on the calyx and corolla, including even the throat of the corolla. Among a lot of others, was one plant about three feet high, spreading three feet in diameter, which, according to estimate, had 7,200 small flies on it at one time.

The hairs are very numerous all over the surface. The glands are acid after a little irritation. None of them are sensitive, as I can find. They vary exceedingly in length, from 3-16 in. to those which are perhaps 1-100 of an inch. Some of them have as many as ten cross partitions. The contents of these cells appear quite clear, except one near the top, next to the top cell. This is larger than several of those below, and contains chlorophyll. It seems to be something like a gland. Above this is a larger cell, with perpendicular striæ along its sides. When fresh and undisturbed, the top is nearly spherical, and resembles a small drop of dew. The secretion is quite copious and exceeding viscid, with an unpleasant odor. I placed some small fragments of raw beef on the glands one morning, but the sun seemed to dry them up, much as it did those left on blades of grass which were destitute of glands. Smaller bits of beef in the shade seemed to be entirely absorbed in some cases. The small insects seem to live but a short time, although they are touched by but two to four or more hairs. The substance appears to be soon taken out of the insects. In my opinion it is a true insectivorous plant.

THE FOREST.

PRODUCTS OF MICHIGAN AT THE CENTENNIAL EXPOSITION.

BY PROF. W. J. BEAL OF THE STATE AGRICULTURAL COLLEGE.

This collection consists of:

First—Cross sections of trunks of our native trees and some prominent introduced species, all of which grow to be over six inches in diameter. The sections, about sixty-five in number, are from seven inches to two and one-half feet in diameter (in one instance reaching seven and one-half feet), and about one and a half inches thick or long.

Second—A collection of about one hundred and forty blocks and twigs, not over six inches in diameter by about six inches in length, with bark mostly on them. Some of these specimens are of shrubs, quite small, not over one-fourth of an inch in diameter. One-sixth of one side of these blocks is planed off vertically; an oblique section is made upon the same side toward the top, leaving the upper surface a little more than half the diameter.

Third—A collection of polished boards, eight by sixteen inches, and a half inch in thickness, in cases where the trees were of sufficient size to admit of it. From smaller trees and shrubs the boards are ten inches long, and of a varying width. The number of boards of each species varies from one to twenty, according to the importance, beauty or peculiarities of the species. These boards are as unlike each other as is possible to find them, for the purpose of exhibiting the wood in all its peculiarities.

Fourth—There are some specimens of other dimensions not uniform in shape, size or finish. These include samples of the valuable hard woods, as oak, hickory, etc., cut in a variety of shapes. The collection includes knots, natural grafts of roots and trunks, oak sticks with deer's antlers imbedded in them, etc. For a detailed account consult the following list.

Fifth—Samples of seeds and cones; a quart or more of about fifty species.

THE LIST OF SPECIMENS.

Each specimen of wood has a number cut on the back or under side or end. This is to avoid any mistake in case a label is rubbed off and lost or obscured in any way.

Placed on or tied to each specimen is a label containing its number, corresponding to the number in this list; also the Latin name, the common name (if it has one), the locality where it grew, and the name of the donor.

The names are arranged as they succeed each other in Gray's Manual of Botany, as follows:

Number.	Latin Name.	Common Name.	Size and Shape.	Locality.	Donor's Name.	Remarks.

THE CONFUSION IN NAMES OF TREES,

and especially of shrubs, as used in various parts of the State, is often quite bewildering. This arises in a great variety of ways among those who have little observation or no knowledge of botany.

The first one on the list is called by some "whitewood" and "tulip-tree," by others "poplar." The latter name is also used for several other species of trees.

Two species of trees are indiscriminately spoken of as "the soft maple." The names of our oaks are a good deal mixed up. This is true of the scientific descriptions as well as of the common names. We have seven species of birch, five of which are trees. Two or three of them are known as "yellow birch" in different sections of the State. Two others are indiscriminately called "the white birch."

Hardly any one, unless a botanist, pretends to know the species of our willows or poplars and cottonwoods. Two or three different species of pine are known in different parts of the State as "scrub pine," "gray pine," "buckwheat pine," "black pine," "jack pine." Of course there is still greater confusion of names and want of any common name among some of the shrubs and

THE RARE TREES.

Some kinds are plenty enough in a few localities, yet quite rare in most parts of the State, while others are never very abundant any where, but scattered here and there over a large extent of territory. I have been unable to find the cucumber tree *(Magnolia acuminata)* in the State. I have heard of it in a number of places, but when hunted up it proved to be the whitewood, tulip tree, or one of the cottonwoods.

It may exist in some of the southern counties. It forms a beautiful and peculiar shade tree, standing our climate quite well in some sections.

The paw paw is an interesting shrub, with a trunk of soft greenish wood, sometimes six inches in diameter. The leaves are simple, long and drooping. It fruits in several counties as far north as Ionia. The fruit looks some like a banana, only it is larger and straighter.

The Ohio Buckeye *(Aesculus glabra)* is found sparingly along the south part of the State. Its appearance is in every way inferior to the horse chestnut, which is cultivated from Asia.

The striped maple and the mountain maple both attain the size of large shrubs. They are rather rare along streams and in rich woods in the center and northern parts of the State.

The box elder, honey maple, or ash-leaved maple *(Negundo aceroides)*, grows sparingly in the south half of the lower peninsula along streams. It does not generally make a straight, nice tree in our State, but farther south and west of us it thrives better, and is sometimes recommended for cultivation for timber.

The red bud or Judas tree *(Cercis Canadensis)* attains the diameter of six or eight inches in the south tier of counties in rich soil. Where hardy, it is worthy of cultivation, on account of its red purple flowers, which appear quite early in spring before the leaves.

The Kentucky coffee tree is not well known by the mass of the people. It is remarkable for its few thick, stumpy limbs and large compound leaves. The bark is quite rough. The tree sometimes bears large, thick, heavy pods an inch and a half wide by four inches in length, containing several hard beans the size of lima beans.

It grows in the south part of the State to Ionia, and sometimes attains a diameter of eighteen inches. The wood is rose colored, showing the grain well.

The honey locust is still more limited in its growth. It is found in rich woods in the south tier of counties, especially along the rivers Raisin and Kalamazoo. The pods are often eight inches long, an inch wide, and quite thin. The tree usually bears branching thorns, but sometimes no thorns are produced. It is valuable for hedges.

Two species of mountain ash grow in the north part of the State, sometimes attaining a diameter of eight inches or more.

The pepperidge, known also as sour gum tree, tupelo, grows about the margins of swamps in the south part of the State. The wood is usually very difficult to split, but some of it splits easily. The limbs stand out horizontally in a peculiar manner, some like those of the beech. The leaves turn bright crimson in autumn. The tree becomes twenty inches or more in diameter, and is worthy of use as an ornamental tree.

There are two elders scattered all over the State, one bearing a flat cluster of black berries, the other a conical cluster of red berries.

The largest specimen of elder comes from Grand Traverse, and is about five inches in diameter.

The red ash and green ash are both doubtful species. They are rather rare, small trees, found along streams. They resemble white ash too closely.

Sassafras is well known, usually as a shrub, but I hear of it over two feet through in the south and in the southwest part of the State in quite a number of places, and in one case in Allegan county four feet four inches in diameter.

The moosewood or leatherwood has the softest wood and the toughest bark of any woody plant in the State. It sometimes attains a diameter of two and a half inches.

The *Shepherdia* is one of the rarest shrubs in the State, growing along the margins of lakes on gravelly banks. It bears insipid yellowish red berries the size of currants. The leaves are covered with rusty scales, especially on the under side.

The hackberry, sugarberry, nettle tree is sparingly found as far north as Midland, and perhaps considerable farther, two feet or more in diameter. I have met but few people who knew the correct name for it. In three counties I hear it called shittim wood. I have often been asked about it. It has rough bark, which turns over in thin rolls. The tree looks some like its cousins, the elms, having its simple leaves in two rows along opposite sides of the stem the same as

elms. The tree bears small sweet berries the size of peas. The wood is of little value except for firewood.

The red mulberry is a rare tree, never growing in groves or clusters that I have heard of in our State. It has milky juice, attains a diameter of nearly two feet. The wood is yellowish and pretty. It grows in rich woods in the southern part of the State.

The western shell bark hickory *(Carya sulcata)* is the one bearing very large nuts with thick shells of a dull yellowish color. It thrives only in the southeast part of the State, so far as I can learn.

The chestnut is confined to the highest land in the southeast part of the State in limited quantity, in Oakland, Washtenaw, Wayne, Monroe and St. Clair counties. It grows well when planted on the sandy land at the Agricultural College, one of the coldest portions of our State.

The white birch *(Betula alba)* is found north of the central part of the southern peninsula. The leaves are small, triangular; the bark is white, not peeling into rolls very freely.

The paper or canoe birch *(Betula papyracea)* also has a white outer bark, which peels freely in thick or thin layers from around the tree. The leaves are larger. It is often confounded with *Betula alba*, both going by the name of white birch.

The balsam poplar grows in the southern peninsula, but scattering, sometimes attaining a diameter of two or even four feet.

The gray or scrub pine *(Pinus Banksiana)* grows from south of Lake Michigan along the western part of the State to the northern part. It also grows along the eastern side, especially to the north, and occasionally on poor land north of the central part.

The yellow pine *(Pinus mitis)* I hear of at Ludington and Elk Rapids. It doubtless occurs in other portions of the State.

White spruce is quite rare. Our fine sample comes from Ludington. It grows in swamps at the north.

Black spruce grows common in swamps at the north, but disappears a little south of Lansing.

Balsam fir is found with spruce and arbor vitae sparingly, but does not get as far south as these trees. It is a most beautiful tree while young, but when twenty or more years old it begins to grow slowly, lose its lower limbs and look forlorn.

White cedar or cypress *(Cupressus thyoides)*. I have looked and inquired in vain for this beautiful tree, but can get no trace of it in Michigan.

Arbor vitæ is very common in the swamps at the north, and is usually known as white cedar. It makes our telegraph poles and many fence posts. I think it is over rated as an ornamental tree, especially on thin sandy land. It is a good tree to trim into ornamental hedges.

Red cedar is found in quite limited quantity along streams and about lakes, here and there all over the State, at least in the southern peninsula. The best trees are nearly all gone. Its timber is a great favorite for pails and tubs and other purposes on account of its color, odor and durability. It grows quite fast with good culture, and even with its brown color in winter is a good tree to plant for ornament.

Among the

MOST COMMON TREES

of the State stand the beech and sugar maple. They are all over the southern peninsula on what is known as timbered land. They are well known everywhere by the same common names for their valuable fire wood. Red beech grows among other trees and has much heart wood; white beech is the same kind of tree grown in more exposed places. There is a similar difference in our species of hickory and American elm. Beech and maple are very perishable when exposed to the changes of the weather.

The sugar maple grows on good land. It is used for wagon axletrees, shoe-lasts, shoe-pegs, ox-yokes, some parts of chairs, for boards and timber not exposed to weather. Sugar is made of the sap. Much of the sugar maple in the north part of the State is curly or birds-eye. It is very nice for furniture and for finishing buildings and railway coaches, especially when used as a veneer. It is a prominent and favorite shade tree.

The white oak is another very valuable tree, found in great abundance in most parts of the southern peninsula. It disappears as we go north among the forests of pine. It is one of our most valuable trees for a great many purposes; for floors, doors and furniture, especially when cut to show the silver grain or medullary rays. It is much used for rails, posts, railroad ties, bridges, planks and hewn timbers, piles, ship building and many other uses. Some of it is very tough, and valuable on this account.

White ash is also widely distributed, prominent and well known all over the State, except limited localities. It stands without a rival for farm implements, for cabinet ware, oars, for floors, for finishing off churches and dwelling houses. It is remarkable for its elasticity, strength and beauty. It grows rapidly to a large tree.

Black walnut is still quite abundant in some parts of the State. It disappears as we go north into the pine timber. Its great value is well known to all for furniture, finishing houses inside. The price has rapidly increased within a few years. The fashion for walnut has not abated.

Black cherry, the timber of which is red, is found with black walnut and farther north. It is not very abundant nor so large as the walnut, oak or white ash. It is not so much used for furniture and finishing churches as formerly. Much school furniture is made of cherry. Perhaps one reason why it is not so fashionable as formerly is that it can be so easily imitated by staining white pine, which is very common and more easily worked. It is much like Mahogany.

Vast forests of nice white pine give Michigan the highest rank as a lumbering State. This is either scattered with other timber north of a line running through Lansing, or in some places it forms large tracts as almost the only timber. The uses of pine are almost endless. It is a general favorite.

Rock or white elm is a very valuable timber on account of its toughness. It is found in the same country with pine and farther south. Large, straight, beautiful trees are found, some of which will make good axe-helves, wagon spokes, fills, farm implements, and it is fit to use in any place where strength and toughness are required.

Shag bark hickory and one or two others which rank as species are very valuable for wagon-makers, especially the second growth, or those trees which grow in exposed places. It is widely distributed, but seldom makes a very large tree.

Black ash is gaining favor. Some of it is considered equal or superior to

chestnut for cabinet ware. It becomes a large tree on rich low land in most parts of the southern peninsula. It has long been used for barrel hoops and bottoming chairs and making baskets. It grows rapidly.

This is not intended as a complete work on forestry. For a fuller account see a valuable work called "Forest Trees for Shelter, Ornament and Profit," by Arthur Bryant, Sr.

GREAT WASTE.

To the best of my knowledge, lumbering has always been overdone in this State. It is in most places very slovenly and wastefully done. Labor is so high and lumber so cheap that the best is culled here and there, a few trees. The tops and refuse are left on the ground. They are very likely to burn in a year or two and destroy the rest of the standing timber. The fire does not stop here, but runs in and destroys the adjacent timber which has been left for future use. It is a great pity that this fearful destruction by fire is not or cannot in some way be prevented.

HIGH TREES.

The exact height of our tallest trees in most cases is not known. They are to be found in some congenial spots where the ground is favorable for a thick growth, in a slight sag in the ground. At Clam Lake an old lumberman informed me that he could furnish spars of pine 175 feet long and not over two feet through at the butt. He had cut them 200 feet long.

LARGE TREES.

Within my recollection a large part of Southern Michigan, which is now in the form of arable land, has been cleared of timber. Our grandfathers, at great labor and expense, cut down, rolled into heaps, and burned the timber from thousands of acres in New York, because they must have room for corn and wheat and meadow. Our fathers did and are still doing the same thing for Michigan. Educated in this way, brought up in the woods, where timber is too plenty, as a people, we have been taught to undervalue timber. There are now living, men who can see no beauty in a tree, except for the cords of wood or loads of lumber, or the hundreds of rails it will make. The lovely elm, with all its grace and beauty, well styled the queen of American trees, shades the border of his meadow, and is a nuisance. He cuts it down. Our large, grand old trees have not been saved, partially because of this lack of love for them. In many places it would be impossible to save them. They would not stand the storms alone when their fellow trees were cut away. In 100 or 200 years it is likely our successors will have and care for large samples of trees which have grown more stocky in exposed places. One of the interesting things now to do is to save what we can and make a record of the size and position of any large trees in Michigan.

We have no written history recording the size and peculiarities of our forest trees. Below I have arranged in a table the name of the tree, the diameter, the locality of the tree, the name of the person giving the information. It is not nearly so full nor so accurate as I should like to make it.

The first part consists of our native trees, arranged with tne common names in alphabetical order.

Common Name.	Diameter of Tree.	Locality.	Authority.
Ash (White)	5½ feet	Saugatuck, Allegan Co	H. D. Post.
Black Ash	3 feet 11 inches	Redford, Wayne Co	J. D. Perry.
Birch	3 feet 6 inches	Hersey, Osceola Co	W. J. Beal.
*Black Cherry	3 feet 6 inches	Argyle, Sanilac Co	J. M. Cole.
Black Cherry	7 feet 6 inches	South Lyons, Oakland Co	David Dunlap.
Box Elder	16 inches	Adrian, Lenawee Co	B. W. Steere.
Buttonwood	8 feet 6 inches	Adrian, Lenawee Co	H. E. Owen.
Buttonwood	8 ft. at 10 ft. above ground	Portland, Ionia Co	W. B. Hopkins.
Buttonwood	11 feet below	Grand Rapids (near.)	David Dunlap.
Black Walnut	9 feet 6 inches	Reading, Hillsdale Co	W. K. Kidder.
Black Walnut	11 feet	Allegan Co	Hiram Bennett.
Balsom Poplar	3 feet 7½ inches	Orion, Oakland Co	Prof. R. C. Carpenter.
Butternut	3 feet 9 inches	Hemlock City, Saginaw Co	H. S. Averill.
Cottonwood	3 feet 6 inches	Locke, Ingham Co	J. C. Martin.
Cottonwood	6 feet	Grattan, Kent Co	Mrs. M. A. Lessiter.
Cottonwood	10 feet	Almont	Joseph Bristol.
Dogwood	9½ inches	Battle Creek	J. A. Robinson.
Elder (Red)	5½ inches	Traverse City	W. N. Adsit.
Elder (Red)	5 inches	Traverse City	M. L. Leach.
Elm (American)	8 feet	Manistee	F. L. Kerr.
Grape Vine	10 inches	South Lyons, Oakland Co	David Dunlap.
Grape Vine	10 inches	Raisinville	Frank Atkinson.
Hickory (pig nut)	3 feet	Battle Creek	J. A. Robinson.
Hickory (shell bark)	2½ feet	Oakwood, Oakland Co	Sloan Cooley.
Hickory (2d growth)	18 inches	Franklin, Oakland Co	David Broughton.
Honey Locust	2 feet	Adrian	
Honey Locust	2 feet	Kalamazoo	H. Dale Adams.
Hemlock Spruce	5 feet	Allegan Co	H. D. Post.
Hemlock Spruce	4 feet 4 inches	Hersey, Osceola Co	W. J. Beal.
Ironwood	19 inches	Walton	E. L. Frazer.
Ironwood	1 foot	Cedar Springs	Philip Dines.
Ironwood	1 foot 3 inches	Birmingham	A. B. Simonson.
Maple (sugar)	5 feet 9 inches	Ionia Co	
Maple (sugar)	6 feet	Otsego Co	
Maple (sugar)	5 feet 3 inches	Gaylord, Otsego Co	Chas. L. Fuller.
Maple (sugar)	4 feet 9 inches	Ferry, Oceana Co	W. D. Webber.
Mulberry (red)	1 foot 3 inches	Portland, Ionia Co	W. B. Hopkins.
Mulberry (red)	1 foot 4½ inches	Dearborn, Wayne Co	A. G. Gulley.
Oak (white)	5 feet	Olive, Allegan Co	H. D. Post.
Oak (swamp)	7 feet 8 inches	Yew, Wayne Co	Wm. Ford.
Oak (white)	7 feet	Johnstown, Barry Co	W. K. Vanryckle.
Oak (white)	8 feet 4 inches	Little Salt River	
Pine (white)	6½ feet	Walton	E. L. Frazer.
Prickly Ash	4 inches	South Lyons	John J. McWhorton.
Pepperidge	2 feet 3 inches	Rollin, Lenawee Co	Norman Andress.
Red Cedar	3 feet	North Port	W. W. Tracy.
Sassafras	2 feet	Little Prairie Ronde, Cass Co.	H. Dale Adams.
Sassafras	4 feet 4 inches	Saugatuck, Allegan Co.	H. D. Post.
Tamarack	3 feet	Lansing, Ingham Co	Truman.
Tamarack	3 feet 4 inches	May, Tuscola Co	Jas. B. Crosby.
White Cedar	4 feet	Cedar River	
White Cedar	4 feet		
White Cedar	5½ feet	Walton	E. L. Frazer.
White Wood	6 feet	Vevay, Ingham Co	C. C. Walker.
White Wood	6 feet	Monroe Co	H. D. Post.
Apple Tree	1 foot 11 inches	Decatur, Van Buren Co	C. H. Morris.
Apple Tree	2 feet 6 inches	Prairie Ronde	Geo. G. Crose.
Apple Tree	1 foot 5 inches	Schoolcraft, Kalamazoo Co	Hosea Cox.
Apple Tree	1 foot 9 inches	Concord	Frank A. Ray.
Apple Tree	3 feet 3 inches	Monroe	Edwin Willits.
Ailanthus	1 foot 6 inches	Mason, Lenawee Co	B. H. Pennington.
Ailanthus	2 feet 1 inch	Farmington, Oakland Co	P. Dean Warner.
Osage Orange	8 inches	Climax	H. Dale Adams.
Pear Tree	3½ feet	Monroe	Edwin Willets.
†Weeping Willow	4 feet 6 inches	Adrian	S. E. Graves.

* Length of trunk 55 feet to first limb.
† This weeping willow has several very large branches about six feet from the ground. Within these branches is a bearing currant bush. The tree was set about forty years ago by Wm. Beal, who then owned the place, situated a mile and a half northeast of Adrian.

We send two sections of a large cottonwood to the Centennial, one section near the ground ten feet across, the other fifty feet above it over three feet in diameter. Five feet above the ground the tree was twenty-seven feet in circumference. The tree was 140 feet high. The first limb was twenty-eight inches in diameter and made two saw logs, each fourteen feet long. The tree grew two and

a half miles south of Almont village. The above items in reference to the cottonwood are furnished by the donor, Mr. Joseph Bristol.

The large specimen board of whitewood or tulip tree came from a tree cut some years ago. The tree made 5,060 feet of lumber. These items are given by John N. Heth, Birmingham.

I am informed of another whitewood tree cut in Shelby which made 5,000 feet of lumber; one board was four and a half feet wide.

The following is taken from the Lansing Republican of April 18, 1876, over the initials G. S. T.:

"I send you statement of logs cut by S. R. Sanford, of Muskegon, a man well known in this State, whose figures are to be relied on. They were scaled merchantable,—that is, all defects were taken out. Had they been scaled at surface they would have shown much larger figures. Take, for example, the first tree. The butt thrown out, it scaled 1,186 feet. Three logs scaled 5,520 feet, and nearly 2,000 feet left in the woods, making nearly 9,000 feet in this one tree.

"The following is a statement of the merchantable scale of twenty trees, cut by S. R. Sanford in the town of Belvidere, Montcalm county, and scaled by William Durno for John White, M. P., of Canada, who owns the land and is lumbering at Grand Haven:

"One tree in 10-feet lengths, 1,186 feet, cut off from butt, 3 logs scaled 5,520 feet; diameter at top 44 inches. One tree in 10-feet lengths, 1,252 feet cut off from butt, 3 logs, scaled 5,471 feet; diameter at top 42 inches. One tree in 8-feet lengths, 987 feet cut off from butt, 3 logs, scaled 4,683 feet; diameter at top 40 inches. One same length, 974 feet off butt, 4 logs, scaled 4,869 feet; diameter at top 31 inches.

No. Logs.	Lengths in feet.	No. logs in tree.	Scaled feet.	Diameter at top in inches.	No. Logs.	Lengths in feet.	No. logs in tree.	Scaled feet.	Diameter at top in inches.
1..........	12				5..........	16	5	7,043	37
1..........	14	4	4,705	33	5..........	16	5	6,412	32
2..........	16				1..........	12			
2..........	14	4	4,587	34	1..........	14	5	6,287	36
2..........	16				3..........	11			
4..........	16	4	4,379	32	5..........	16	5	6,149	35
4..........	....	4	4,652	35	5..........	16	5	6,432	38
1..........	12	4	4,593	33	5..........	16	5	5,831	32
3..........	16				5..........	16	5	5,672	31
2..........	14	4	4,649	31	2..........	12	5	5,148	30
2..........	16				3..........	16			
1..........	12	4	5,173	36					
3..........	16								

A total of 85 logs, scaling 107,455 feet. The largest log scaled (merchantable) 2,025 feet; several scaled 1,700 feet and over; and 200 logs scaled an average of over 900 feet each log."

The logs were mostly cork pine, *i. e.*, a sort of white pine with wood very soft and nice to work.

VALUABLE TREES.

Some trees prove of great value because of the peculiarity of the grain or color. If I am rightly informed, a walnut tree in Potterville sold for $1,000, as the

wood was in beautiful waves. It was made into veneering. Mr. J. W. King, of Lansing, bought a black walnut tree seven feet through in Brookfield. He sold it for nearly $1,200 to be cut up into veneering in New York. Mr. H. D. Post, of Saugatuck, Allegan Co., tells me of a blistered walnut, very dark in color, which lay for some years in the water near Grand Rapids. The owner cut it into veneering for his own use, after refusing $2,000 for it.

Doubtless many a valuable log has been cut into fire-wood, or rolled into a log-heap and burned, or sawed into boards for a hog-pen by ignorant people not knowing its real worth.

At Grand Rapids I learned of a black cherry with very dark wood which was shipped to Central America, and from there shipped back to this country as good mahogany.

In the north part of the State, as at Otsego and Petoskey, there is some very fine curly and bird's eye maple. Considerable quantities are going to Europe. Some choice trees of rock elm, white oak, and white ash are also going to Europe, besides to nearly all parts of our own country, either in the unfinished state or after being first manufacturéd into some articles of furniture.

NATURAL GRAFTING

is very common with various kinds of roots, and not uncommon with the branches of trees and shrubs.

We send one or two small samples of root grafting and some of top grafting as found in the natural state.

In Branch county stand two trees, twelve feet apart, each about twelve inches through. They run up twelve feet, when one starts off horizontally and strikes the other, when they grow together in one body. I heard of a specimen, perhaps not now standing, two pines, about four feet apart, diameters twenty-six and twenty inches respectively. About sixteen feet from the ground they are joined by a tie six inches in diameter. Above the point of union the smaller tree becomes the largest,

Mr. George Rowell, of Bennington, Shiawassee Co., writes of two beeches now growing on his farm. They are about eighteen inches in diameter near the ground, thrifty and straight. About twenty feet above the ground they are joined together. The trunks are nearly covered with the names of persons who have made them a visit, some of them dating back thirty years. I should say of these beeches, which go to the Centennial, "united we stood, united we fell."

Mr. L. B. Peck, of Muskegon, writes: "On the farm of William H. Hubbard, in the township of Ferry (Reed P. O.), Oceana county, is a specimen of natural grafting. Two trees, standing some fifteen feet apart, are united together some ten feet high, forming from thence upward a perfect single top, with a smooth, round, natural trunk. Having seen it but a few moments, I am not able to give a very precise description,—not even to name the variety of timber, but I think the two are of the same."

Mr. E. J. Shirts, of Shelby, Oceana Co., sends a drawing and description of two sugar maples in his section grown together. The larger tree stands up straight, and is about two feet in diameter. The smaller tree is fifty feet from the larger one, and is about one foot in diameter. The small one, some eight feet from the ground, is bent over and touches the larger one where the graft occurs, thirty feet above the ground. At the point of union the large tree is twenty inches and the small one six inches in diameter.

I have looked many times at forest trees of different genera which had appar-

ently grown together by root, trunk or limbs, but on cutting into them I never found the least union of the wood.

KNOTS.

Mr. Warren Brown, Flint, writes as follows in reference to a huge oak knot which he donates: "The tree is nearly three feet at the butt. The wart is ten feet up the tree and is sound as a nut. I should have it made into a punch bowl, neatly carved. This wart goes round the tree within ten inches. Around the tree over the knot the tree is in circumference about twenty-five feet."

Sanford Keeler, Superintendent of the Flint & Pere Marquette Railroad, sends a portion of a pine tree which made a complete turn around and then grew on straight. The curl was about 30 feet from the ground and there was six inches in diameter.

Hon. J. Webster Childs sends a mallet made of a black ash knot. It is well made and is a beautiful specimen, showing a variety of faces or sides of the grain.

Mr. V. G. Canfield, Lansing, gives a cut from a knot of black walnut. One side we have polished; the other shows the bark.

DEER'S ANTLER IN A TREE.

A part of one is imbedded in an oak rail from a tree two feet in diameter, where it remained some years before it was discovered. By estimate the horn was about nine feet from the ground when the tree was standing. This was sent by Augustus Schmidt, of Kalamazoo, at the suggestion of H. Dale Adams.

A. B. Wetherbee, of Cass County, sends the following: The deer's horn in this case is about 16 inches long and has two branches, one projecting obliquely up alongside, and the other passing horizontally into and through the heart of the tree. The point of the upper branch is perfect; the lower one is somewhat damaged, and the base of the horn, fixed in the sap-wood of the tree, shows proofs of its former attachment to the head of the deer. The tree is perfectly sound, and is an ordinary white oak, 22 inches in diameter. It was first noticed by the early settlers about 36 years ago, when the tree was but eight or ten inches in diameter, with the horn projecting apparently through the center; the points disappeared about ten years ago, and when the tree was cut, March 7, 1876, only a small portion of the bone attached to the horn was visible.

The writer remembers seeing a specimen at the University of Michigan much like the one sent by Mr. Wetherbee.

In all these cases we suppose some one hung the antler on the limb of a tree out of the reach of wolves and dogs, or to place it where he could find it on some future occasion.

Allen & Co., Lansing, send a model of their new patent window blind made of the rich, beautiful wood of staghorn sumach.

WHAT TREES TO PLANT.

It may seem strange to hear of raising trees for timber in Michigan, but our people will soon begin to raise some kinds, and some of us will live to see it in all probability. So far as we can judge now our best trees to raise for timber are white ash, hickory, black walnut, white pine, white oak, European larch, and chestnut. An acre of timber raised, cultivated and properly cared for is of much more value than an acre of forest trees of the same species.

At the Agricultural College we have begun in a small way to raise some of our native trees, some foreign ones also, to see which will prove of most value for future generations to grow for profit, shelter and ornament.

We all know that our forests are of great value and that they are

RAPIDLY DISAPPEARING.

Maine was but a few years ago a great lumbering State. Her valuable pine is now about all gone. The same is true of Northern New York. In Pennsylvania, at the present rate, all the good timber will be gone in three years. Of course some of it will be kept longer. Michigan is now the great headquarters for valuable lumber. Two-thirds of the best in the markets of New York, Philadelphia and Boston goes from Michigan. Some of it goes to Germany and Great Britain.

Besides the demand at the East, Michigan supplies immense quantities of lumber to the cities and prairies of the southwest.

No other country of its size on this continent or any other has so much hard and soft wood valuable for hewing and for boards as the northern half of the southern peninsula of Michigan.

THE FORESTS OF GREAT BRITAIN.

It is human nature for us all to praise our own country. Even the poor men of Lapland and Iceland do this. To comprehend the relative importance of Michigan timber, let us take a glance at the forests of Great Britain. Great Britain and Ireland contain 121,260 square miles of land, Michigan 60,000, a little less than one-half as much as Great Britain. She has one species of basswood not so good as ours; one maple not over twenty feet high; one cherry, from ten to twenty feet high; one small ash, two elms, two poplars, one beech, which grows very large but not very high (sometimes ninety feet around), one small white birch, one species of pine, by no means a match for our white pine, a species of oak which sometimes grows to a great size (seventy feet in circumference). But the trees in many places there do not grow as thickly as they do here. They branch out low. They are magnificent trees for a park, a kind of second growth, but not very good for logs of hewn or sawed timber.

Great Britain, we see, has about ten species of trees natives of her soil. Michigan, with half the territory, has about ninety species, nine times as great a variety. Of course so old a country has introduced a great many species from other climates. Great Britain has no white wood (tulip tree), no white or red cedar, no walnuts or hickories. Michigan has six species of maple of tree size, a basswood, a white wood, honey locust, Kentucky coffee tree, two cherries, a pepperidge, five species of ash, a sassafras, three elms, a hackberry, a mulberry, a buttonwood, black walnut, butternut, six hickories, about twelve oaks, a chestnut, a beech, five tree birches, four or six willows of tree size, six poplars, five or more pines, four spruces, one larch, one arbor vitæ, and a red cedar.

THE FORESTS OF SOUTH AMERICA.

I have never had the privilege of a visit to tropical climes, but I have read the remarks of others who have. I have lately had a long visit from Dr. J. B. Steere, of our own State, who has spent over five years in a trip around the world, passing across South America in the widest place, along the Amazon, visiting some of China, the tropical islands east and south of the Hindostan, Egypt, France, Great Britain, etc. During all these five years he has been collecting birds, land shells, plants, etc. He has been in the forests a great deal of the time. He is a very good botanist. In all his travels he saw no forests to compare with the grandeur of our northern forests of pines. In the tropics there are 6,000 species of trees on a territory where we should find sixty species, 100 times as great a variety there as here. There might there be one, two or

three trees of a kind on an acre. As the climate along the Amazon is always mild, the leaves are always on the trees and always dying. There is nothing bleak as our winter; there is no fresh, universal thrifty green like our June.

Dr. Steere saw some large trees now and then six to seven feet in diameter; one grove of Brazil nut trees three feet through and trunks eighty feet high on the Upper Paru river. They stood as thick as sugar maples stand in some parts of our State. All the valuable and fragrant woods he noticed have only a very small heart (the only valuable part) surrounded by an immense growth of sap wood of no value. The best of the timber in this State for boards and hewing grows thick and tall and straight, usually much of it good and of a few kinds on a single acre. Where the soil is not favorable, the trees are more scattering, broader, crooked, and less valuable.

A THOROUGH SURVEY OF THE STATE

in reference to its trrees, shrubs, and herbaceous plants, with some fine illustrations, would be of great interest and value in many respects. This has been strongly impressed upon my mind more especially while engaged in making a collection for the centennial. The timber which is large or most valuable has already been cut away in many of the older parts of the State. While facts can be easily obtained of the older settlers in reference to the trees, they should be collected and recorded by text and maps and other means. Such a work well done would not only interest men of science, but farmers, mechanics, nurserymen, all classes of intelligent persons. Massachusetts has a good report of two volumes lately revised for a second edition.

THE DIFFICULTIES OF COLLECTING

good specimens of such a great variety of trees and shrubs in so short a time with no money to pay for them have been very great. Many of the specimens are not known by any one but a good botanist. Every body was asked through the State press to give information and to help about making a collection. The invitation was so general, and the people so numerous that nearly all waited for others. Many who replied very generously offered valuable aid in getting fine specimens, but when asked, most of these gave the matter no further attention or found some good excuse for not complying with the request. Some were very slow. In many places the roads were very bad nearly all winter. After being offered specimens, then asking for them, and again being assured they would certainly be sent, and then several letters written to hurry up and encourage the person, I often found as the time approached for the specimens to be ready that I must go without them or get them from some other source.

A large specimen often proved hollow or rotten and worthless, or the owner had sold the place and the new proprietor wasn't patriotic.

One promises to get forest seeds. He gets them, but when too late to get them from other sources, they are spoiled by some accident.

One man offers, without price, a nice apple tree which blew over the summer previous. He is asked for it, and replies, "I could receive from ten to twelve dollars for it for turning purposes. Now if you will, or can through your influence and business, assist me to get a pass to the Centennial, I will ship you the tree. Let me hear from you soon."

Another man is sure he can get a nice ailanthus, but it is not on his place. He tries, but the man's wife doesn't want to spare it. He was sorry he had said anything about furnishing the tree. So was I.

A Kentucky coffee tree was promised, as the owner had two nice ones. When asked, after some delay, he finds another man who is willing to furnish a tree,

which, fortunately, he is prompt to do. All kinds of inquiries were made by letter. I mention one, "what would be the prospect for making money at the Centennial by a brass band made up of nine brothers?"

But there was

A BRIGHT SIDE

to the labor of making the collection. It gave the writer an opportunity to learn more about the *flora* of our State, which so abounds in interesting things.

Quite a number of men deserve especial mention for their sacrifice and prompt response to a call for specimens.

L. H. Foster, Ludington, deserves great credit for supplying eight fine birch logs of three specimens; also logs of white spruce, mountain ash, and others.

Hosea Cox, of Schoolcraft, with no delay went fifteen miles and obtained at his own expense a large red cedar log for the Centennial.

S. Alexander, of Birmingham, deserves mention here for promptness in sending valuable blocks of willows and oaks.

Mr. C. E. Sumner, of Monroe Co., also furnished at considerable trouble and expense several fine specimens.

Joseph Bristol, of Almont, furnished the largest tree, a cottonwood, which was costly to handle.

Israel Pennington and son were very self-sacrificing in going a long way in muddy time to deliver, without charge, trunks of nice trees set for ornament on their own place years before.

Warren Brown, of Flint, was one of the first to respond to the call by furnishing the huge knot referred to in another place.

Mr. George Rowell employed ten men to help get the twin beeches down and to the railroad.

A. B. Wetherbee, Cass Co., delivered at the railroad with very short notice the choice sample of oak containing the buck's horn.

Hon. O. M. Barnes, of Lansing, was very prompt in furnishing whatever was asked along the Jackson, Lansing & Saginaw Railroad.

Perhaps others deserve especial notice for promptness and work in this good cause, but space hardly permits a special notice of every person.

Most of the specimens of trees and shrubs were collected and prepared at the expense of the Agricultural College.

Especial mention is due to the officers of the Flint & Pere Marquette Railway for granting free transit for myself and for specimens which were collected along their railroad.

The same acknowledgment should here be made to the officers of the Michigan Central Railway and all their leased lines, to Detroit, Lansing & Lake Michigan Railway, and to the officers of the Detroit & Milwaukee Railway, and the Grand Rapids & Indiana Railway, and Chicago & Lake Huron Railway.

OTHER DONORS DESERVING MENTION.

John N. Heth, Birmingham, large whitewood board.
Phœnix Manufacturing Co., Grand Rapids, 20 samples of 4x10-inch boards.
George W. Breck, Paw Paw, four logs.
W. W. Reynolds, Cass Co., seeds of paw paw.
D. Harden & Co., Saginaw, 25 boards 8x16 inches.
J. J. McWhorton, South Lyons, 1 large prickly ash.
H. A. Atkins, Locke, large sumach log.
C. F. Wheeler, Birmingham, 1 shrub.

C. E. Sumner, Lambertville, 2 kinds seeds, 12 logs.
Morrice & Crandall, Little Traverse, 1 log, 2 shrubs.
Jessie Hoyt, East Saginaw, 10 boards 8x16-inch, 1 section pine.
W. S. Cole, Cooperville, 2 boards 8x16-inch.
H. E. Owen, Adrian, 2 logs, 3 shrubs.
Israel Pennington & Son, Macon, 2 logs.
R. C. Carpenter, Agricultural College, 2 logs.
J. W. Post, Lansing, 1 shrub.
W. N. Adsit, Traverse City, 2 shrubs, 6 quarts seeds.
Austin, Tomlinson & Webster, 3 samples wagon timber.
D. T. Fox, Kalamazoo, 1 shrub.
A. G. Gulley, Dearborn, 1 log.
J. A. Robinson, Battle Creek, 3 logs, 2 small boards.
W. R. Kidder, Hillsdale, block of walnut.
V. G. Canfield, Lansing, 1 walnut knot.
Allen & Co., Lansing, 8 boards 8x16 inches.
W. Burcham, Lansing, 1 log.
Mr. Tower, North Lansing, 2 logs.
J. Van Wormer, Monroe, 2 hardwood planks.
Dr. Daniel Broughton, 1 large hardwood plank.
J. F. Formir, Lyons, board 20x12-inches.
S. W. Walker, Wayne, 2 chestnut logs.
B. W. Steere, Adrian, burrs of chestnut.
S. Alexander, Birmingham, 2 sections 3 logs.
J. O. Beal, Rollin, 6 logs, 1 lot cones.
J. R. Hawkins, Rollin, 1 tree.
Wm. Lamb, Rollin, 1 tree.
Hosea Cox, Three Rivers, 1 red cedar log.
Hon. S. O. Knapp, Jackson, 1 log, 1 shrub.
Rev. E. H. Day, Highland, 2 logs, 1 lot seeds.
H. Dale Adams & Augustus Schmidt, deer's antler in rail.
Warren Brown, Flint, 1 oak knot.
J. E. Taylor, Greenville, 1 natural graft.
Nelson, Matter & Co., Grand Rapids, about 40 finished boards 8x16-inches.
J. S. Dowd, Hartford, 1 log.
Philip Dines, Cedar Springs, 2 natural grafts.
A. H. Seeley, Hudson, 1 vine.
J. H. Lawrence, California, Mich., 1 board 8x20-inch.
S. S. Schoville & Co., Coldwater, samples wagon timber.

OF THE BEAUTY OF OUR FORESTS

I may say but little at this time. The full beauty is best appreciated by the student who knows and studies each one as friend talks to friend. To enjoy the full beauties of our forest scenery, it is necessary that one should possess a good knowledge of botany, landscape gardening, and to know something of drawing and painting. To such a person, a trip through the forests is a perpetual delight, which cannot be understood by the uninitiated. The mixtures of evergreens and deciduous-leaved trees, the shrubs, the autumn tints, the streams, the hills and valleys, our beautiful lakes with the different seasons of the year, and different phases of the weather, lend a perpetual charm and freshness to our Michigan woodlands.

LIST OF DONATIONS

TO THE AGRICULTURAL COLLEGE DURING THE YEAR 1875.

DONATIONS TO THE LIBRARY.*

From the SECRETARY OF STATE, Michigan:
Senate Journal, 1871 (vol. 2), 1872, 1873 (vols. 1 and 2), 1874; House Journal, 1871 (vols. 1, 2, and 3), 1873 (vols. 1 and 2), 1874; Constitutional Commission Journal, 1873; Joint Documents, 1860, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871 (parts 1 and 2), 1872 (parts 1, 2, and 3), 1873 (parts 1, 2, and 3); Laws of Michigan, 1872; Statistics of Michigan, 1854, 1860, 1870; Vital Statistics, Michigan, 1870, 1871; Fifth Registration Report, 1871; Report of State Board of Agriculture, 1872; Report of State Pomological Society, 1873; Report of State Board of Health, 1873, 1874; Compiled Laws, 1857; School Laws, 1873; School Reports, 1861, 1862, 1863, 1864, 1865, 1866, 1867, 1868, 1869, 1870, 1871, 1872; Laws on Highways and Bridges, 1875, 3 copies; Adjutant General's Report, 1862, 1863, 1865–6 (parts 1, 2, and 3).

From STATE LIBRARIAN, Michigan:
Statutes at Large, U. S., 1872–3, 1873–4; Catalogue of State Library, 1875–6; Michigan Court Reports (vols. 26, 27, and 28).

From RAILROAD COMMISSIONER, Michigan:
Report, 1873.

From FISH COMMISSIONER, Michigan:
Report, 1873.

From AUDITOR GENERAL, Michigan:
Report, 1874.

From DEPARTMENT OF INTERIOR, U. S., at request of Gov. J. J. Bagley:
Statistical Atlas of the United States (parts I., II., and III.)

From DEPARTMENT OF AGRICULTURE, U. S.:
Monthly Reports, 1875.

From BUREAU OF EDUCATION, U. S.:
Circulars of Information (Nos. 1 and 2, 1875).

From SMITHSONIAN INSTITUTION:
Report, 1869, 1871, 1873, 1874.

From T. P. PATTERSON, Superintendent:
United States Coast Survey, 1871.

From REAR ADMIRAL B. F. SANDS:
Meteorological Observations at U. S. Naval Observatory, Washington, 1872.

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*A list of the periodicals furnished by Publishers is to be found in the Report of the Librarian.

From Hon. Z. Chandler, U. S. S.:
VIIIth Census, U. S., 1860 (4 vols.); U. S. Coast Survey, 1870, 1871.
From Hon. T. W. Ferry, U. S. S.:
Congressional Globe, 42d Congress, 1872–3, (parts 1, 2, and Appendix).
From T. Glover, Department of Agriculture:
Lithographic Copy of Manuscript Notes on Insects, Diptera.
From Childrens' Aid Society, New York:
Annual Report, 1874.
From Prohibition State Central Committee:
Speech of Hon. A. Williams, 3 copies.
From Mercantile Library, San Francisco, California:
Report of Library, 1874.
From W. S. George & Co., Lansing:
Legislative Manual, 1875.
From Pres. W. S. Clark, Amherst, Mass.:
Twelfth Annual Report of Massachusetts Agricultural College, Jan., 1875.
From Rutgers' Scientific School:
Tenth Report, 1874.
From Fruit Growers' Association of Ontario, Canada:
Report, with Proceedings of Entomological Society, 1874.
From Prof. C. E. Bessey, Ames, Iowa.
Pamphlet, "Insects Injurious to Plants," and Animals of the Farm.
From Illinois Horticultural Society:
Reports 2, 3, 4, 5, 6, 7, 8 (1868–1874).
From the New York Fish Commissioners:
Report, 1874.
From Township Superintendent, Lansing:
School Laws, 1872, School Reports, 1872.
Report of Superintendent of Public Instruction, 1873.
From H. G. Reynolds, M. S., Class of 1870:
An impression from a tomb in Upper Egypt, and $3.00 to frame it.
From Geo. H. Cook, Secretary:
Report of New Jersey Board of Agriculture, 1874.
From Prof. N. H. Winchell:
Report of Geological and Zoölogical Survey of Minnesota, 1873, 1874.
From Messrs. Ginn Brothers:
Allen and Greenough's Latin Composition.
From President Abbot:
Transactions of Nebraska Horticultural Society, 1874; Subject for investigation of the Georgia State Agricultural Society, 1872; Fifty-seventh Report of American Education Society, 1873; Clark's Observation on the Phenomena of Plant Life, 1875.
From Prof. M. Miles:
Index to "The Genus Unio."
From Prof. R. C. Kedzie:
Report of the Michigan State Board of Health, 1874; Transactions of Michigan State Medical Society, 1875.
From Prof. J. J. Anderson, New York, and Prof. Jesse McIntire, Oakland County.
Back numbers of The Michigan Teacher.

From PUBLISHERS:
Several numbers of the Detroit Review of Medicine, to complete files.
From PUBLISHERS, DEALERS, AND OTHERS:
Numerous Cataloges, Specimen Copies, etc.

DONATIONS TO THE MUSEUM.

From F. W. HASTINGS:
One Stone Hatchet (Indian), one Arrow Head and one Indian Drill.
From CLEMENT J. STRANG:
One Stone Hatchet.
From F. I. DUNN:
One Arrow Head.
From G. TROOP:
One Arrow Head.
From RALPH SESSIONS:
Four Arrow Heads; one Shell.
From S. P. TRACY:
Inferior Maxillary Bones of the Cerour Virginianus, found four feet under the earth's surface.
From MR. ROBSON:
One Corydalis Cornutus.
From MR. E. THOMPSON:
One Carydolis Cornutus.
From HENRY S. WHIPPLE:
One Indian Arrow.
From E. ANDERSON:
One Arrow Head; Spirifer Shells.
From OLIVER FOOT:
One Arrow Head; one Stone Hatchet; one Crenoid Head Selenite Agate.
From J. R. MONROE:
One Arrow Head.
From A. J. CAMPBELL:
One Arrow Head.
From DR. H. A. ATKINS:
One Arrow Head; Clay Rock; Granite; Quartz; and one Arrow Head from Locke, Ingham County.
From B. A. NEVINS:
Lepidodendron.
From J. P. LEWIS:
Cyprea.
From JOHN HARVEY:
One Stone Arrow Head and one Stone Hatchet.
From GEO. A. ROYCE:
Three specimens of Snakes from Florida.
From DIX BROWN:
Two Arrow Heads, Sept. 22d, 1875.
From EUGENE DAVENPORT:
One Arrow Head, from Woodland, Barry County.
From DR. H. A. ATKINS:
One Arrow Head, from Locke, Ingham County.
From H. G. REYNOLDS:
Specimens of Mummy Cloth, collected by him in Egypt.

From G. TROOP:
One Indian relic.
From DR. KEDZIE:
Two Stone Axes; two Stone Hammers; one fossil Calanite Stone; one fossil Sigillaria Stone; one fossil Stem with the wood replaced by Iron Pyrites.
From PROF. A. J. COOK:
One small Stone Hammer; one Stone Ax; one Chent Arrow Head.

THE HORTICULTURAL DEPARTMENT.

From U. S. AGRICULTURAL DEPARTMENT:
Beans,—Pole Southern Prolific, Red Speckled Valentine, Dwarf Black Wax; beet,—Smooth Long Dark Blood, Long Blood Red; brocoli,—Early White Large, French (imported from France); cabbage,—Large York, Late Drumhead, Early Winning Stidt, Jersey, Wakefield; cucumber,—Long Green, Early, White Spine; carrot,—Long Orange, Cress Garden (imported); celery,—Grant White Solid; corn,—Locust or Sugar, Sugar Eight Rowed; egg-plant,—Large Round (imported N. Y.); endive,—Broad Leaved (imported), Dwarf German; lettuce,—All the Year Round, Royal Cabbage; leek,—Large Bower; melon,—Netted Nutmeg, Persian or Casaba; onions,—Red Wethersfield, Large Yellow Strasburg, White Portugal; okra, —Prolific; pumpkins,—Yellow Mammouth; pepper,—Cayenne; parsley, Doubled Curled; parsnip,—Fine Sugar; Radish,—White Turnip-rooted, Half Long Scarlet; squash,—Summer Crooknecked, Yellow Bush, Scollop; spinach,—Flanders; brussels sprouts,—Dwarf Imported; salsify; tomato,—Tilden, Trophy; turnip,—Yellow Aberdeen, Imperial Brunswick, Ruta Baga; water-melon,—Phinney's Early, Mountain Sprout.
From A. SIGLER, Adrian, Mich.:
Grape, Rose, and cutting of others.
From E. BRADFIELD:
Two dozen grape vines of several varieties.
From PROF. H. P. BARTLETT, Lansing:
Clematis.
From WM. WELD, London:
One-half pound Emporium wheat; one-half pound Emporium oats.
From BROOKS, HINMAN & Co., Battle Creek, Mich.:
Two-horse cultivator.

ENGINEERING DEPARTMENT.

From DETROIT BRIDGE AND IRON WORKS:
One lithographic plate of St. Joseph bridge; 1 lithographic plate of Rouge river bridge on M. C. R. R.; 1 lithographic plate of iron draw bridge; 1 lithographic plate of iron girder bridge; 1 lithographic plate of iron highway bridge; 1 lithographic plate of iron (wrought) bridge; 1 lithographic plate of iron (wrought) trestle; 1 lithographic plate of combination bridge; 1 lithographic plate of bridge over Des Plaines river; 1 lithographic plate of bridge over Mississippi river at Hannibal, Mo.; 1 lithographic plate of Bear creek bridge; 1 lithographic plate of roof of gas house, Detroit; 1 lithographic plate of roof of blacksmith shops, Ill. C. R. R.; 1 lithographic plate of roof of M. C. R. R. car shops; 1 lithographic plate of general plan of iron roof; 1 lithographic plate from Keystone Bridge Company of Tenville & Piper's patent truss bridge and of hollow wrought iron rivetless columns.

DEPARTMENT OF AGRICULTURE.

From HELEN S. NORTON, Howell, Michigan;
Two bushels winter white wheat from Bitlis, Armenia, Asia.

From DEPARTMENT OF AGRICULTURE, Washington, D. C.:
Sixteen quarts Clawson winter wheat; 8 quarts white winter rye; 12 bags oats, 1 quart each, Canadian (imported) from England; 12 bags oats,—White Schonen (imported), each bag 1 quart; 10 bags, each 1 quart, wheat,—Square Head (imported); mangel-wurzel,—Red Globe, 4 bags 1 quart each; beet,—Improved Sugar, 4 bags 1 quart each.

APIARY.

From A. I. ROOT, Medina, Ohio:
One honey extractor.

STATE AGRICULTURAL SOCIETY.

PROCEEDINGS AND REPORTS FOR THE YEAR 1875.

MICHIGAN STATE AGRICULTURAL SOCIETY,
OFFICE OF THE SECRETARY,
Pontiac, Michigan, December 20, 1875.

To the Honorable President and Executive Committee:

GENTLEMEN:—I have the honor herewith to submit the detailed annual report of the proceedings of the Michigan State Agricultural Society for the year 1875.

Your obedient servant,
C. F. KIMBALL,
Secretary.

PROCEEDINGS OF THE EXECUTIVE COMMITTEE.

PONTIAC, MICH., January 13, 1875.

In accordance with previous notice, the Executive Committee assembled at the office of the Secretary Tuesday morning at 9 o'clock.

Called to order by President Humphrey. Roll called and the following committeemen and officers answered to their names: E. O. Humphrey, Kalamazoo; C. F. Kimball, Pontiac; A. J. Dean, Adrian; Edwin Phelps, Pontiac, Oakland county; J. Q. A. Burrington, Worth, Tuscola county; J. P. Allison, East Saginaw, Saginaw county; E. Van Valkenburgh, Hillsdale, Hillsdale county; J. Webster Childs, Ypsilanti, Washtenaw county; D. A. Blodgett, Hersey, Osceola county; Joseph M. Sterling, Monroe, Monroe county; C. W. Green, Farmington, Oakland county; William M. Ferry, Grand Haven, Ottawa county; A. O. Hyde, Marshall, Calhoun county; C. L. Whitney, Muskegon, Muskegon county; J. M. French, Detroit, Wayne county; J. G. Ramsdell, Traverse city, Grand Traverse county; W. G. Beckwith, Cassopolis, Cass county; W. J. Baxter, Jonesville, Hillsdale county.

The President read the following letter from the retiring President, Mr. Kipp, which was ordered spread upon the records:

PRESIDENT'S OFFICE,
St. Johns, Mich., January 11, 1875.

DEAR SIR:—Owing to circumstances entirely beyond my control, it will be impossible for me to be present at the opening of the meeting of the Executive Committee to-morrow.

Please convey to the committee my regrets at this occurrence, and tender to them my grateful acknowledgments for their hearty co-operation, kind indulgence, and uniform courtesy extended to me during the year.

And I desire to express to the Superintendents in charge of the various departments my sincere thanks for the kind and gentlemanly manner in which they performed their respective duties, and I desire to express through the committee especially the thanks of the Society to the people of Saginaw Valley for their hearty co-operation with the officers of the Society in making the Fair of 1874 a grand success.

And to the police of East Saginaw, the thanks of the officers of the Society are gratefully tendered for the very efficient manner in which they discharged their arduous duties during the Fair.

With my best wishes for the future prosperity of the Michigan State Agricultural Society, I remain, very respectfully,

CHARLES KIPP.

To C. F. KIMBALL, Esq., Secretary.

President Humphrey addressed the committee. At the close of the address, on motion of Mr. Baxter, it was referred to a special committee consisting of Messrs. Baxter, Childs, and Sterling.

Gentlemen of the Executive Committee, and members of the State Agricultura Society:

In accepting the position of President and entering upon its official duties, I do it with gratitude and humility; and for the undeserved compliment to which by your kindness I have been elevated, allow me to thank you. Believing that your generosity will prove to be of sufficient compass to enable you to overlook all the shortcomings and imperfections which may be observed in your presiding officer, gives me hopeful assurance that my administration may be successfully devised. I can assure you that so far as my humble abilities permit, there shall not be wanting on my part attention to the advancement of the best interest of the Society.

I take great pleasure in knowing that this Society has been so successful in its usefulness, and is now on good footing; and you who have stood by it and labored earnestly and devotedly through the most trying vicissitudes of its existence are entitled to the thanks and grateful remembrance of every individual in this State, and I wish to impress upon you the importance of the continuation of your efforts to sustain and build up this Society in the future as you have in the past. I know you have contributed your time for days and weeks annually, a portion of you since its organization. But let me say to you, gentlemen, this is not all for no pay: you are building yourselves a lasting monument that will stand to your memory after this organization shall have passed out of your hands to be controlled by others who shall succeed you.

One of the principal conditions on which depends our agricultural progress, is increased respect for labor and agricultural pursuits. In many portions of our State, this condition is amply fulfilled and the healthful results are plainly seen in finely cultivated farms, in improved homes, in education, thrift, and all pursuits of an honest, intelligent, and respected industry. Farmers should cherish not only a high respect for their employment themselves, but instill their convictions into the minds of their children. It is not only a great mistake, but a great misfortune that young men should feel dissatisfied with the comparatively slow gains of agriculture, or that they should regard the farmer's life

as one of tameness and drudgery. They notice the rapid growth of the property of the merchant, the trader, or the professional man, and see him in situations of apparent comfort and ease, limiting, however, their observation to the few who are successful and not noticing the many who fail of ultimate success. It is estimated from careful observation that in our principal cities and towns, that of all those who engage in trade, not more than one out of one hundred succeed in accumulating wealth according to their expectations. The farmer, if not absolutely rich, is at least independent. He has a home which his labor and his taste have adorned. His broad acres are not held by lease as in many countries, but as a freehold. Let the farmer, therefore, as a cultivated man, magnify his occupation. In all ages wise, learned, and good men have gladly turned away from the employment of public life to the pleasures, the consolations and the quietude of rural pursuits. Without citing the men of other countries and ages, who can forget how eagerly Washington laid aside his robes of office and sought the repose of Mount Vernon; how gladly Clay returned to the shades of Ashland after the excitement and honors of congressional life; and how Webster hastened from the cares of State to his herds and fields, all endeared to him by the sweet memories of rural life? Men who have chosen to follow other avocations of life, and who pursue them with success, still long for the pleasures and employments of the farm. All their plans of life have a kind of natural culmination in the determination to return into the country, and share with the farmer the healthful and dignified occupation of husbandry.

The fundamental idea in the organization of agricultural societies was to better the condition of the farming class, by introducing such improvements in the various branches of husbandry as would secure the best returns for the outlay of labor and capital. Affording amusement to the people any further than amusement could be desired from objects of actual utility was not contemplated. This is undoubtedly the true groundwork for such associations. Of course the plan is intended to include encouragement to those branches of industry with which agriculture is connected. When legislatures incorporate agricultural societies, or provide for their organization, it is on the condition that they shall attempt the improvement of agriculture. The holding of exhibitions is supposed to be the means by which we can accomplish this object. To effect the greatest good by these exhibitions much judgment is required in the offering of premiums, and equal judgment is required in making the awards. In general, the amount of the premiums should be graduated by the utility of the object for which it is offered. Exceptions, however, may properly be made in reference to objects which require special encouragement for a time. Unwarrantable prominence has been given by our Society to the horse.

It is well known that under the name of trials of speed we have made racing and trotting matches the principal features of our exhibitions. It is not unusual, I believe, that the largest premiums offered are those for the fastest trotting: a great display is made of this in the bills, and it seems to be relied on as the greatest inducement that can be presented to the public to attend the fairs. The arrangement of the grounds and the most expensive fixtures for the accommodation of the people have special reference to these trials of speed. The excitement incident to these displays is naturally attractive to the people who attend the exhibitions merely for amusement, especially to the young; and the crowd which lingers around the stand shows that the benefit which might be derived from close examination of the more useful parts of the exhibition is chiefly lost. And is there any real improvement to the usefulness of the horse

effected or even contemplated by these premiums on trials of speed? A pretty thorough acquaintance with the manner in which these trials of speed have been gotten up leads to the conclusion that they are chiefly for the benefit of gamblers and horse tricksters. The public at large are only paid in the amusement which the occasions offer; and that, my belief is, costs more than it is worth. But the worst aspect of the case has not been noticed. Disguise it as you will, these contests are in principle nothing more than those instituted by gambling associations where horses compete for purses. As the public mind becomes accustomed to the spectacle it approximates nearer and nearer to the gambler's scheme until even now we see at the exhibitions of some of our leading agricultural societies the most open betting on these trials of speed. In view of these facts will any one contend that these examples are calculated to improve either the breeds of horses or the morals of men? The argument that these speed tests are necessary to the support of agricultural societies is believed to be entirely fallacious. Does experience teach that the class of people who are particularly interested in mere amusements can be permanently relied on in important enterprises? On the contrary, is it not well understood that their characteristic capriciousness may at any moment jeopardize the success of any undertaking? The true friends of agriculture are disgusted by frivolous and immoral proceedings, and stand aloof or withdraw their support, and we are thus deprived of the aid of the most trustworthy citizens.

The horse is one of the most useful of our domestic animals, and his improvement should not be overlooked by our society. Several classes or breeds of horses are required,—such as the draft horse, the farm horse, or horse for general use, and the roadster. In awarding premiums on this class it would be proper to take into consideration all the properties required to make the best horse for road purposes. One of these properties is speed, though not in a higher degree than is likely to be wanted by the horse in the performance of his legitimate duties. The New York State Agricultural Society, one of the oldest, most useful and influential associations of this character in the country, has from the beginning steadily refused to offer speed premiums. It has never allowed trials of speed on the grounds, and has never set apart any more ground for horses than was simply required to fairly show their gait, yet large crowds have always attended the exhibitions of this society. Canada, whose people are earnestly devoted to the improvement of agriculture, makes exhibitions of a highly creditable character, and which are numerously attended by the people. They have no trials of speed.

Let us be careful that our annual fairs do not become demoralizing to those who attend them, by the introduction of horse-racing or any other immoral element under the auspices of the society, but steadily pursue the object of our organization.

I would recommend a liberal policy in the regulations for exhibitors in all the departments of our fair.

I wish to call your special attention to the Pomological Department, which I regard as a most important branch in our fairs. The able manner in which these exhibitions are being conducted is worthy of our most generous consideration; is a credit to our State, and is attracting attention in other States as a model institution of its kind. I would suggest that this society treat that department by word and deed with all the liberality consistent with its ability so to do.

I am thoroughly convinced that an entire week is too long a time for our fair to continue for the convenience and comfort of exhibitors and visitors, as well as

those who have the fair in charge. My belief is that four days is all the time that is profitable to hold the fair; that gives ample time for the examination of animals and articles in every department, and sufficient time for all those who wish to visit the fair. I can see no object in undertaking to hold the crowd, even if we should have the power to do it, for an unreasonable length of time, or so long that they will have no desire to attend another fair during their natural lives. I would recommend that the fair shall close on Friday. That will give all in attendance a fair prospect of reaching their homes before Sunday, which I have no doubt will be profitable as well as agreeable for most people.

The time for the Centennial Exposition at Philadelphia is approaching, and it seems to me that this society should at least make an effort to stimulate our people to the preparation for a magnificent display of the products of Michigan in that exposition, with all our available resources, and we make the most of our opportunity. I know no reason why Michigan should not take a front seat in that exposition with any other State or country. I deem it important that we should commence early to perfect our arrangements that we may secure suitable space for our products.

Adjourned to 1 o'clock P. M. C. F. KIMBALL, *Secretary.*

Met as per adjournment at 1 o'clock P. M. Called to order by the President. Roll called and quorum present.

The Treasurer submitted his report for the year 1874, stating the total receipts at $31,716.54.

The report was received and referred to the Finance Committee, with the following resolution of instructions:

Resolved, That the Finance Committee be instructed in reporting upon the Treasurer's report, to itemize and classify the expenses as nearly as possible, so as to show the particular and aggregate expenses of each particular department.

The Secretary presented his report of the proceedings of the Society for 1874; the financial portion of which was referred to the Financial Committee, under the same resolution.

Mr. Baxter presented the following report from the Committee on President's Address:

The special committee, to whom was referred the President's address, with instructions to recommend the reference of the different features to appropriate committees, recommend its reference as follows:

1st. So much as refers to the general encouragement of agriculture be referred to the Committee of the Whole.

2d. That so much of it as refers to the undue prominence given to horses and to trials of speed, be referred to the Committee of the Whole, and also to Committee on Premiums.

3d. That so much as refers to the number of days the annual fair shall be held, be referred to the Business Committee.

4th. That so much as refers to special encouragement to Pomological Department, be referred to the Finance Committee.

5th. That so much as refers to participation in the Centennial, be referred to a special committee of five, to be appointed by the President.

Respectfully submitted.

W. J. BAXTER,
J. W. CHILDS,
J. M. STERLING,
Committee.

On motion of Mr. Greene the committee on constitution and by-laws were given further time to report, and Messrs. Sterling, Ferry and Ramsdell were added to the committee with Messrs. Baxter and Childs.

The following communications were received from East Saginaw through Mr. Allison and ordered spread upon the records:

At a meeting of the Executive Committee of the Saginaw County Agricultural Society, held December 26, 1874, the following resolution was adopted and ordered spread upon the records of the Society:

Resolved, That the use of the buildings and grounds of the Saginaw County Agricultural Society be and the same are hereby tendered to the Michigan State Agricultural Society, for the purposes of their annual fair for the year 1875: *Provided*, That the State Society be required to return said buildings and grounds in as good condition as when taken by them.

And further, that John P. Allison be delegated to present the same to the Executive Committee of the State Society.

A. A. PARSONS,
Secretary Saginaw Co. Agricultural Society.

Moved and supported that the East Saginaw Driving Park and buildings be tendered to the State Fair Association for their use for the purpose of their fair for the year 1875: *Provided*, They prorate the receipts of the grand stand to the amount of eight hundred and fifty (850) dollars during the holding of said fair: *Provided further*, That they return the same in as good condition as when taken.

I hereby certify that the above is a resolution adopted by the East Saginaw Driving Park Association of East Saginaw January 6, 1875.

E. N. WICKES, *Secretary pro tem.*

The Secretary presented the communication from the Volinia Farmers' Club, under its entry for premium, which on motion was ordered read in committee of the whole at some future hour.

President Humphrey announced the following committees:

On Finance—Committeemen Phillips, Hyde and Rising.

On Premium List—Committeemen Beckwith, Burrington, Hanford, Avery, Phelps and Van Valkenburg.

Adjourned to 9 o'clock A. M. on Wednesday.

Approved.

Wednesday Morning, 13th.

Called to order by the President. Roll called: quorum present.

The protest in Division B, Class 12, referred to Superintendents Humphrey, Rising, and Howard, Sept. 18th, with instructions to report at the winter meeting, was called up, and the committee (through Mr. Rising) reported, sustaining the awards of the committee. The report was received, and Mr. Baxter moved its adoption, and it was adopted.

The protest in Class 13 was reported upon from same committee in like manner, and the report was adopted.

The protest against award in Division C, Class 23, Essex Swine, was reported upon by Supt. Rising, sustaining the awarding committee; on motion the report was received and adopted.

Mr. Angel being absent, the protest in Division F, Class 33, was referred to a new committee, consisting of Messrs. Hanford and Rising.

On motion of Mr. Beckwith, the action of the committee, at its session in 1873, in sustaining the protest of King Bros. against the award in Cultivator Class, at fair in 1873, was reconsidered.

Mr. Baxter moved the reference of the whole to committeemen Hanford and Rising; withdrawn.

The question now being upon report of committee sustaining the protest, Mr. Hanford addressed the committee upon the subject, stating that the whole question turned upon a matter of fact. If a waiver of trials was unanimous, then the award was just; if the waiver was not unanimous, then, under the rules of the society, the award was null.

Mr. Hammond, of Ann Arbor, and Mr. Knapp, of Adrian, also addressed the meeting. It was moved by Mr. Beckwith that the report of the awarding committee be sustained; the ayes and nays were called for. The vote was decided in the affirmative as follows:

Ayes—Humphrey, Dean, Burrington, Manning, Allison, Childs, Rising, Sterling, French, Ramsdell, Beckwith, Baxter,—12.

Nays—Kimball, Phelps, Hanford, Blodgett, Greene, Ferry, Whitney,—7.

Mr. Baxter moved that the first thing to be considered in the afternoon session shall be the location of the next fair. Adopted.

Adjourned to 1:30 P. M.

WEDNESDAY, 13TH—AFTERNOON SESSION.

Called to order. Quorum present.

The consideration of the matter of location of the Fair for 1875 being in order, the communications submitted to the committee from the citizens of East Saginaw yesterday were taken from the table and read.

Mr. Baxter, Col. Ferry, Mr. Childs, Mr. Tuthill, Mr. Bartow, and Mr. Allison addressed the committee.

On motion of Mr. Allison a committee of three was appointed to proceed to East Saginaw and arrange for and locate the Fair for 1875, consisting of Messrs. Baxter, Greene, and Kipp.

Col. Ferry offered the following resolution, which was adopted:

Resolved, That the committee on location be authorized to complete by contract such necessary arrangements for holding the next annual fair as in their judgment shall be deemed necessary.

On motion the committee from the Pomological Society were granted a hearing, and Mr. Knapp, of Jackson, was introduced to the committee, and spoke at some length regarding the needs and expectations of the society which he represented, stating that his society would need $1,500 for premiums for the coming year.

H. Dale Adams, on behalf of the Pomological Society, presented the following estimate of the wants of his Society:

AMOUNTS FOR STATE POMOLOGICAL SOCIETY.

For am't overdrawn on Treasurer	$179 50
Due Secretary	200 00
Premium list for 1875	1,500 00
Secretary's salary for 1875	600 00
Expenses of fair (same as last year)	300 00
Expenses incident to holding meetings in different parts of the State, and expenses of orchard committee	220 50
Total amount	$3,000 00

President Parmalee, of the Pomological Society, addressed the committee at length upon the subject of the Pomological Society.

Mr. Baxter offered the following resolutions, and moved their adoption:

No. 1. *Resolved*, That the State Pomological Society be invited to exhibit with us, and as a department of this society, at the next annual fair.

No. 2. *Resolved further*, That if the above invitation is accepted, said society be authorized to offer premiums to the amount of $1,500, which premiums, so far as awarded, shall be paid by this society in the same manner as paid in 1874.

No. 3. *Resolved further*, That if such invitation is accepted, the sum of $500 be paid by this society on the order of said society, on the last day of the fair, to meet the necessary expenses in preparing for and making such exhibition.

No. 4. *Resolved further*, If such invitation is accepted, that the further sum of $1,000 be appropriated to said society for general purposes.

No. 5. *Resolved further*, That the present action of this society shall not be held or regarded as a precedent for future action.

Mr. Ramsdell, Mr. Greene, Col. Ferry, Mr. Childs, and others addressed the committee in favor of the resolution.

Mr. Van Valkenburgh and Mr. Beckwith addressed the committee in opposition to granting so large an appropriation. Further consideration of the subject was deferred till to-morrow morning.

The following resolution offered by Mr. Baxter was adopted:

Resolved, That the action of the Business committee, in the matter of the report of the special committee on certain protests entered in the horse department sustaining such protests on the grounds of fraudulent entries and misrepresentations, and in expelling certain animals and members from the National Association, and from this Society, on account of such fraudulent entries and misrepresentations reported to this board by said business committee through the Secretary of this Society, be sustained and adopted as the action of this board. Adopted.

Mr. Baxter offered the following resolution, which on motion was laid on the table:

Resolved, That the State Agricultural College be invited to exhibit at our next Fair, in all the several departments, and thus endeavor to secure among the members of this Society a better knowledge of the aims, affairs, and success of said institution.

The report of the committee on the protests in class 33 was presented, read and adopted, and is as follows:

The committee to whom was referred the protest on the award of the committee on plows and their trials, respectfully report that from the testimony presented the viewing committee failed to make a test of all the plows entered for trial; therefore that they had no just basis to work upon to make an award, and we recommend that the said protest should be sustained. We also recommend that the premiums withheld in said class, not included in said protest, be paid, and that the discretionary premium recommended on the best plow for marsh land, amounting to $5, shall be awarded and paid.

H. O. HANFORD,
E. W. RISING,
Committee.

On motion, adjourned until Thursday morning, at 10 o'clock.

Thursday Morning, January 14th.

Called to order by the President.

Quorum present.

Minutes read and approved.

On motion, the resolution inviting the Agricultural College Farm to exhibit at our next Fair was taken up.

Mr. Greene offered an amendment that the resolution read "and compete for premiums." Supported.

Judge Ramsdell offered a substitute for the amendment, that they exhibit in competition on all articles and animals raised or bred on the State Farm, which substitute was accepted by Mr. Greene and its adoption moved.

Judge Ramsdell and others addressed the committee in favor of, and Mr. Childs and Mr. Baxter against the substitute amendment.

The amendments were withdrawn and the resolution as originally offered was adopted as follows:

Resolved, That the State Agricultural College be invited to exhibit at our next annual Fair in all the several departments, and thus endeavor to secure among the members of this Society a better knowledge of the aims and success of said institution.

Hon. C. W. Greene, from the committee to visit the Provincial Fair of Canada, made a report verbally, which on motion the chairman aforesaid was requested to file for record.

That portion of the above report referring to the Canadian premium list was referred to the premium list committee.

Hon. J. M. Sterling from the Railroad committee reported as follows, regarding the liabilities of the Society to refund certain freights paid by exhibitors upon articles and animals on exhibition at the Fair of 1874, and which freights the Michigan Southern & Lake Shore railroad company and Port Huron & Lake Michigan railroad company refuse to refund, which on motion was adopted:

Robert Moore, Adrian, Lake Shore & Michigan Southern	$3 66
E. Driggs, Adrian, Lake Shore & Michigan Southern	3 11
Avery & Murphy, Port Huron, Chicago & Lake Huron	62 50
J. P. Sandborn, Port Huron, Chicago & Lake Huron	62 55
John Button, Coldwater, Lake Shore & Michigan Southern	18 78
D. C. Morehouse, Coldwater, Lake Shore & Michigan Southern	11 60
J. D. Moyener, Burr Oak, Lake Shore & Michigan Southern	16 60
Total	$178 78

Your committee beg leave to report the above amounts due exhibitors for transportation prepaid by them and not yet refunded as we propose in our rules and regulations, and recommend orders be drawn on our Treasurer for the same.

J. M. STERLING, *Chairman.*

The memorial of R. F. Johnstone, in regard to his claim against the Society, was received and referred to a committee consisting of Judge Ramsdell, Dr. Blodgett, and J. M. French.

The report of the committee in Division K, Class 58, was received and adopted, as follows:

LANSING, Jan. 11th, 1875.

To the Executive Committee Michigan State Agricultural Society:

GENTLEMEN:—Your awarding committee on "Text Books for Primary Schools" (Class 58, Division K) beg leave to submit the following report:

Eleven entries were made for the premiums offered in this class, and the same were found classified in the entry book, as follows:

TEXT BOOKS ON AGRICULTURE.

1. Treatise on Manures and Farmers' Guide, by Wm. H. Buckner.
2. Fesquet's Ville on Chemical Treasures, by Henry Cary Baird.

3. Klippart's Land Drainage, by Robert Clarke & Co.
4. Treatise on Agriculture (Manuscript) by Robert L. Bunbury.
5. Liebig's Agricultural Chemistry.

TEXT BOOKS ON FRUIT CULTURE AND CULTURE OF ORNAMENTAL AND FOREST TREES.

1. Thomas' American Fruit Culturist, by William Wood & Co.
2. Warder's Du Breuil on Vineyard Culture, by Robert Clarke & Co.

TEXT BOOK ON CULTURE OF FLOWERS IN HOUSE AND GARDEN.

1. Williams' Window Gardening, by Henry T. Williams.

TEXT BOOK ON DRAWING AND ARCHITECTURE.

1. Treatise on Elementary Drawing, by Mrs. Emma Obernauer.

BOOKS ENTERED BUT UNCLASSIFIED.

1. Treatise on Book-Keeping, by I. H. Goldsmith.
2. Reemelin's Wine-Maker's Manual.

All of the above mentioned books have been in the hands of the committee for inspection, and the same have been reviewed with considerable care, and were this morning transmitted to the Secretary of the Society for your own examination and disposal. We are clearly of the opinion that none of them answer the purpose in view. Some fail to treat of any subject embraced in the class, and the others are so lacking in simplicity and arrangement as to render them entirely unsuitable as text books for primary schools. Hence we should not be justified in making any awards.

Studies that relate both to vegetable and animal life, having manifestly both a direct and indirect practical value, should be, in our view, introduced early in public school education. They should in some measure be taught as early as anything is taught. But it must be admitted that it would be impracticable to introduce these studies early unless handled by skillful teachers, and the schools supplied with books suitable for the prosecution of these studies,—books which unfold the principles by use of the simplest language, divested so far as possible of technical terms, and only such things be treated of as can be comprehended by the child; all else to be left for future stages of the pupil's progress. A child can obviously be easily interested and instructed by teaching him facts about the nature, growth, and habits of plants and animals; but the difficulties which have been experienced, in the main, in attempts to teach these natural sciences to the young, have arisen simply from a disregard of the two rules hinted at above, viz.: Discard technical terms and attempt to teach only such things as can be comprehended. The fault has been not so much that of teacher perhaps, as of those who make the text books—the guides for teaching. These are, as is very manifest, constructed for the most part in violation of the principles above stated. And as most teachers follow the mode of teaching that they find in the books they use, it is of prime importance that these should be constructed aright.

Whatever is done, therefore, by societies or individuals to encourage the production of suitable books on the subjects embraced in Class 58, and their introduction into the public schools of the State, should receive the hearty approval of every friend of popular education.

Respectfully submitted in behalf of the committee.

DANIEL B. BRIGGS,
Chairman.

Application for a correction of the record, and completion of the award of committee in Class 15, Division B, concerning Bailey's horse, was received and referred to Superintendent Hyde.

Application and letter from Mr. Heaton, of Jackson, regarding a booth, received and referred to Finance Committee.

Application for restoration of the horse Dominion Boy, referred to committee consisting of Messrs. Dean, French, and Howard.

Applications for allowance of bills—Ladies of St. Paul's Church, East Saginaw, and bills from sundry other parties—referred to Finance Committee.

Memorial of Mr. Sotham referred to ex-Superintendent Wolverton.

The papers filed by the Volinia Farmers' Club to complete entry for Farmers' Club premium, referred to committee consisting of Messrs. Rising, Childs, and Greene.

Bill of *Wilkes' Spirit* for advertising in 1867, referred to Finance Committee.

Adjourned to the Hodges House at 2 P. M.

Afternoon Session, January 14th.

Met at the Hodges House as per adjournment, and place of meeting changed to Secretary's office.

The first in order of business being the pomological resolutions offered by Mr. Baxter on Wednesday, it was moved by Mr. Baxter that the vote be upon each resolution separately. Adopted.

The resolutions numbered 1, 2, and 3 of the series offered by Mr. Baxter were, on motion, severally adopted.

It was moved that the following be added to the 4th resolution: "To be used by them as a department of this Society in advancing its general interests as such, and provided that orders shall only be drawn for the same, or any part thereof, as aforesaid, and that each order shall specify the particular object for which the same is drawn, and that no part of the same shall be used for payment of salaries of any officers, employés, or committeemen of said Society."

Adopted by the following vote:

Ayes—Humphrey, Dean, Van Valkenburgh, Howard, Hanford, Childs, Blodgett, Phillips, Sterling, Greene, Hyde, French, Ramsdell, Baxter.

Nays—Kimball, Phelps, Burrington, Manning, Allison, Rising, Beckwith, Kipp.

Ayes 14, nays 8.

The 4th resolution thus amended was adopted by the following vote:

Ayes—Humphrey, Dean, Manning, Allison, Howard, Childs, Blodgett, Phillips, Sterling, Greene, Hyde, French, Ramsdell, Baxter.

Nays—Kimball, Phelps, Burrington, Hanford, Van Valkenburgh, Rising, Beckwith, Kipp.

Ayes 14, nays 8.

On motion of Judge Ramsdell,

Resolved, That any member of the Michigan State Agricultural Society shall have the privilege of exhibiting in the Pomological department without the payment of further fee, or becoming a member of the Michigan State Pomological Society.

Adopted.

On motion adjourned to 7 o'clock P. M.

Evening Session, January 14.

Met at the Secretary's office. Called to order by the President. Roll called and quorum present.

Mr. Phelps, from committee on Premium List, reported by classes as they occurred in premium list of 1874.

Committee was requested to make supplemental report on saddle horses.

Moved by Mr. Baxter that no percentage be charged upon sweepstakes for anything but animals. Adopted.

Mr. A. Sidney King, a machinist and manufacturer, was introduced and spoke upon the consideration due the class of industry he represents, and presented the following paper, which was read:

To the Honorable the Executive Committee of the Michigan State Agricultural Society:

We, the undersigned, manufacturers of the State of Michigan, would respectfully submit to your consideration some suggestions looking to the better encouragement of exhibitors of farm implements, in the Division F, as enumerated in your premium list of 1874, and included in the five classes from 33 to 37, inclusive; and we would suggest that while a trial test of the leading articles in these classes would be most desirable, the history of such attempts at trials as have been made or can be made during their yearly meetings, are at the best miserable failures, for various reasons beyond the control of both the society and exhibitors, and would recommend their discontinuance in the future.

That these five classes include all the prominent tools used by farmers, and their importance is hardly recognized by the offer of premiums. That the manufacture of these implements is an important branch of the industry of the State at the present time, and we think demands at your hands a more important consideration than it has received from your society in years past; and we would further—by way of comparison between this branch of industry and others which you recognize—call your attention to the comparative estimate by way of premiums, our manufactures seem to be held in by your society. The five (5) classes above referred to are awarded a cash premium, all told, of seventy-four (74) dollars, while in Division G, Class 40, vehicles, one class of no more importance than any one of the five classes enumerated, you offer some two hundred dollars cash premiums. Division I, Class 43, home-made goods, representing no particular capital invested, you offer premiums, one hundred and twenty-three dollars cash; and so we might continue the list. While we do not complain of the past action of your society in this matter, the growing interest of business in this department demands at your hands a proper consideration, and we trust that it only needs your attention to be called to this matter to have it amended. We think a proper consideration of this matter would warrant you in offering two hundred dollars to each of the five classes referred to; and with a view to call out a still better exhibition of these articles, we suggest that you offer a first and second premium of the above amount on the prominent articles in each of those classes. Say Class 33, ploughs should be the important article and should constitute this class, only two premiums to be given, 1st and 2d. Class 34 includes cultivators and harrows: let wheel cultivators be the prominent article in this class, with first and second premiums: small cultivators and harrows as now, a nominal sum as premium. Class 35, seed drills cover this class, two premiums, first and second. Class 36: the prominent article in this class is the wheel rake—first and second premium on this; minor articles in this class to remain as now. Class 37: this class includes as important articles, feed-cutters, corn-shellers, horse-powers, and wood-saws, for farm use; and we would suggest that feed-cutters and corn-shellers should have a first and second premium, and horse-powers and saws should make another class, with first and second premiums: minor articles in this class to be the same as now. We are of the opinion that such a change in your premium list would call out a much larger display of tools in this department, and would thereby promote both the interest of the manufacturer and the consumer, and would thereby promote the interests of your society. We would recommend that the style and finish of tools should have its proper consideration in making the award of premiums, as tending to encourage a better class of manufactured goods.

ANN ARBOR AGRICULTURAL CO.,
DWIGHT & BURRELL,
GALE MANUFACTURING CO.,
W. D. KING & CO.

Bills allowed.—John E. Wells, Deputy U. S. Marshal, East Saginaw, asked $30; allowed $20.

It was moved by Mr. Greene and adopted, that an additional premium of $10 be allowed Dr. P. L. Schuyler, of Lansing, for saddle horse.

On motion of Mr. Beckwith, Division H was referred to a special committee with instructions to change the awards in certain cases to medals and money, to an amount not to exceed $200. Adopted. The President, on motion, was made chairman, with Messrs. Beckwith and Kimball as such committee.

On motion Division L was referred to the same committee.

With the above exceptions the report of the premium list committee was adopted, with the sundry amendments made and noted. (See list appended.)

Messrs. Van Valkenburgh and Phelps, from the premium list committee, reported a list of premiums for speed prizes, and its adoption was moved and supported.

Mr. Beckwith moved that the premiums for running races be stricken out, and the amount so offered to be added to the present or new speed classes for trotting; which motion was lost. The report of the committee was adopted.

Mr. Dean offered the following resolution, which was adopted:

Resolved, That premiums to the amount of $100 be offered for imported draft stallions of any breed, or those bred from both imported sire and dam, four years old and over, as follows: First premium, $50; second premium, $30; third premium, $20. Animals to be sound, and to weigh not less than 1,500 pounds each.

Mr. Childs, from the Committee on Farmers' Clubs, reported as follows, which was adopted:

The special committee appointed to award premiums "to the farmers' club of any township in the State of Michigan which should furnish to the committee evidence that their greatest amount of improvement in the system of cultivation in the township of its location has been accomplished through the organization and efforts of said club," would respectfully report that in this class but one entry has been made, that of the "Volinia Farmers' Club," of the township of Volinia, in Cass county. The said club was organized in 1865, and has been in very successful operation to the present time. A full history of the organization, object, manner of conducting the said club, and the results of the same, as seen in connection with the improvement and success in the system of the agriculture of the township, has been spread before your committee, showing on the part of those engaged therein thorough system, great perseverance, earnest and long continued interest, with most gratifying results. Able and carefully written essays upon various important questions connected with the interests of agriculture, have from time to time been presented for the consideration of the members of the said club, several of which essays your committee have had the opportunity of examining, and take pleasure in speaking of them as possessing great merit, and believing that the said club is well worthy the premium offered, and your committee would recommend that the same be thus awarded.

E. W. RISING,
J. WEBSTER CHILDS,
G. W. PHILLIPS,
Committee.

Adjourned to Friday morning at 9 o'clock.

Friday, January, 15, 1875.

Called to order by the President. Roll called, and quorum present.

Minutes read.

Mr. Baxter offered the following resolutions, which were adopted:

Resolved, That no viewing committees be appointed at this meeting in Divisions A, B, C, and D, and that the appointment of viewing committees for each of said divisions be referred to the Superintendents, who shall be appointed to take charge of said divisions, acting together as a committee, under such regulations as they deem advisable. That the names of such committeemen shall not be published in premium list, or disclosed until the proper time for viewing the animals or awarding the premiums.

Resolved, That so much of the rule in Division A, Class 10, as requires that "not less than three of the animals exhibited in herd shall be bred by the exhibitor" shall be stricken out.

Resolved, That the same premiums be offered to local notices in the coming fair as in 1874.

J. M. Sterling offered the following resolution, which was adopted:

Resolved, That the State of Michigan should be represented at the exhibition of the American Pomological Society, meeting in Chicago the coming fall, and that it is our request that the Michigan State Pomological Society make such exhibition of fruits and flowers as in their opinion will be creditable to the State they represent, and is compatible with the funds already appropriated by this Society.

The committee to whom was referred the memorial of R. F. Johnstone, reported as follows:

To the Executive Committee of the State Agricultural Society:

Your committee, to whom was referred the claims of R. F. Johnstone against this Society, for past services as Secretary thereof, with instructions to examine the same, and report whether or not this Society is under legal obligations to pay said claim, have instructed me to report as follows:

First, So much of the claim as relates to services rendered before the first day of January, A. D. 1869, amounting to $866, are, in the opinion of your committee, barred by the statutes of limitation.

Second, That the provision in article 6, which provides that the Executive Committee shall obey the instructions which shall be given to it at the annual meeting of the Society, is but the expression of a fundamental principle which is binding upon the committee, and that the provision in Art. 9, which provides that the Executive Committee shall allow said Secretary such sum for past and future services as they deem advisable, can only be construed to give the committee such powers in the absence of such instruction, and *not* in violation of them, and therefore that the resolution passed at the annual meeting of 1867, directing the same committee to fix the salary at not less than $1,200 per year, was equivalent to fixing the salary at that sum for that year, with power to the committee to raise it to a higher sum.

Third, Your committee find as a matter of fact that the Executive Committee, with the full knowledge of the said R. F. Johnstone, assumed to fix the Secretary's salary at $1,000 for the year 1868, and for all years thereafter that the said claimant acted as its Secretary, that said Johnstone received the $1,000 for each year from the Society, with full knowledge that the Society considered and intended it as full compensation for his services, and neither protested nor in any other manner made it known to said Society, or to its officers, until after the expiration of his term of service, that he did not consider and receive the same as full compensation for such services; that the said Society elected him from year to year as its Secretary without any knowledge that he claimed a higher compensation than that fixed by the committee, and which he had accepted. Therefore, as a matter of law, your committee give it as their opinion that the Society, when the said Johnstone accepted said office and entered upon his duties in the year 1868, and each year of his service thereafter, had a right to believe that the said Secretary intended to, and was willing to discharge the duties of that office for the sum of one thousand dollars per annum, and that the said claimant must be deemed in law to have waived any claim to a greater compensation.

Fourth, Upon limited investigation which your committee have been able to make in the matter before them, they are of opinion that were it not for the bar interposed by the statute of limitation, the said claimant would be legally entitled to receive from this Society the sum of two hundred dollars with interest from the first day of January, 1869, and the sum of four hundred dollars with interest from the first day of January, 1868. All of which is respectfully submitted.

J. G. RAMSDELL,
Chairman.

The first clause of the report was adopted.

The second clause of the report was rejected by an aye and no vote as follows:

Ayes—Dean, Manning, Allison, Sterling, Greene, French, Ramsdell, Kipp—8.

Nays—Humphrey, Kimball, Howard, Hanford, Phillips, Rising, Hyde, Beckwith, Baxter, Burrington—10.

The third clause was adopted.

The fourth clause was rejected and indefinitely postponed:

Ayes—Kimball, Dean, Manning, Allison, Sterling, Greene, French, Ramsdell, Kipp.—9.

Nays—Humphrey, Burrington, Howard, Hanford, Phillips, Rising, Hyde, Beckwith, Baxter—9.

The Spirit of the Times bill of George Wilkes, for advertising in 1867, was reported from the Finance Committee with the recommendation that it has no merit. Adopted.

Record was ordered corrected in Class 14, Division B, giving the award to Mr. Bailey of first premium, as originally intended.

The following North Michigan accounts were allowed, and orders ordered drawn:

Geo. Willard & Co.	$2 00
John H. Mitchell & Co.	2 00
German Printing Co.	2 00

Moved and adopted that order No. 9, new series, North Michigan Agricultural Society, Wright C. Allen, be paid.

Also that the Treasurer and Secretary present a statement of the condition of the accounts of the North Michigan Agricultural Society with the State Society.

From Finance Committee:

Claim of Pilcher & Brown, of Jackson, reported upon as paid by offset at the time of Jackson fair. Adopted.

The Finance Committee reported upon Treasurer's and Secretary's accounts as follows:

To the President and Executive Committee of the Michigan State Agricultural Society:

GENTS—Your committee to whom was referred the amount of C. F. Kimball, Secretary, do respectfully report. By examination we find that orders have been drawn for the following items in amount as follows:

Paid bills for previous years		$289 16
Executive Committee, cash advanced as expenses	1,394 85	
And hotel bill at Saginaw	1,000 00	
		2,394 85
North Michigan Agricultural Society		321 53
Paid postage		189 04
Freight, express, telegraph, drayage, and traveling expenses of Secretary		242 12
State Pomological Society appropriation	1,300 00	
Printing	200 00	
		1,500 00
Letter heads, envelopes, and various circulars, for the Executive Committee and for Secretary's office		110 00
Cost of State Agricultural premium list 1874, less Pomological Department		482 76
Clerk hire and current expenses paid by Secretary		636 07
Music for fair		450 00
Ticket boxes	40 50	
Certificates of membership and tickets	100 05	
		140 55
Aquariums, expenses of		102 72
Salary of Secretary		1,000 00
Machinery hall power	436 08	
Advertising for proposals	13 80	
		449 88
Cost of new diploma and 500 copies		746 00
Traveling expenses, printing for and expenses on track, Speed Department		297 75
Printing for and expenses chargeable to booths		65 50
Silver medals and engraving		225 25
State Fair posters, posting same, also 20,000 circular papers, and current printing during fair		770 46
Publishing premium awards for fair 1874		108 50
Entry register, entry sheets, tags, and committee books		100 10
Printing invitations and circulars for military		8 00

Printing note circulars, and notice to Awarding Committee		$14 75
Preparing exhibition grounds and buildings at East Saginaw		503 30
Carpenters and workmen on fair ground		243 08
Lumber and hardware for fitting exhibition buildings		476 38
Additional water pipe, expense at East Saginaw		154 37
Pro rata of grand stand receipts	1,025 75	
Booth receipts	500 00	
		1,525 75
Forage expense		1,148 00
Dinner ticket expense		276 70
Marshal, police, and gate-keepers		1,073 20
Sawdust for halls		77 00
		$16,122 77
Amount of speed orders issued		12,743 50
		$28,866 27

All of which is respectfully submitted.
Pontiac, January 14, 1875.

A. O. HYDE,
E. W. RISING,
G. W. PHILLIPS,
Finance Committee.

To the President and Executive Committee of the State Agricultural Society:

Your committee on finance, to whom was referred the amount of A. J. Dean, treasurer of said society, beg leave to report as follows:

We find balance in hands of Treasurer on last annual settlement, Dec. 16, 1873		$14,020 44
Error in footing last year's account		20 00
Cash received for one mem. ticket		1 00
G. W. Griggs, booth rent		10 00
1874.		
Feb.	D., L. & L. M. R. R. Co.	59 16
	C. F. Kimball, Sec'y	273 00
Sept. 14.	J. P. Allison	12 50
Sept. 16.	C. F. Kimball (gate police)	1 90
	J. P. Allison	4 75
	J. P. Allison	4 00
	Gate money from police	1 50
Sept. 18.	J. M. Sterling	6 00
Sept. 17.	J. P. Allison	3 00
Oct. 10.	M. C. R. R. 5 per cent	485 31
Sept. 19.	Admission tickets	20,014 00
	Grand stand tickets	2,051 50
Nov. 26.	C. F. Kimball	52 00
Dec. 30.	C. F. Kimball, draft on Detroit	308 25
	Business orders and prem. check, C. F. Kimball, per voucher	8,043 00
	Interest on $8,000 from Feb. 1st, '74, to Jan. 1st, '75,—11 mos.	366 67
Total receipts		$45,736 78

Amount paid out as shown by vouchers examined by us:

Orders of 1873, not paid at time of settlement	$600 00	
Prem. Checks, 1874	12,224 00	
Business orders, 1874	16,120 46	
Pomo. orders, 1874	1,197 00	
		$30,141 96
Leaving balance on hand		$15,595 02

All of which was respectfully submitted.
Pontiac Jan. 14, 1875.

A. O. HYDE,
G. W. PHILLIPS,
E. W. RISING,
Finance Committee.

The bond of the treasurer for 1875 was presented and unanimously adopted.

Ex-Supt. Wolverton presented a claim from Wm. Smith, of Detroit, for $150, which amount Mr. Wolverton stated that he promised Mr. Smith on behalf of the society if he would exhibit his stock.

It was moved that the claim be paid. Adopted.

Mr. Sotham's memorial for remuneration was reported back without recommendation by Mr. Wolverton, and referred to the finance committee.

The finance committee reported the bill of M. D. Brown for work, amounting to $34.85, to be allowed at $31.85.

Report adopted.

Adjourned till 1:30 P. M.

Afternoon Session.

Roll called.

Quorum present.

Mr. Greene moved that a discretionary premium of $15, recommended in class for draught for a 2-year-old entered by Mr. Cox, of Wayne, be awarded. Also a premium of $10 in same class to Edwin Phelps.

Adopted.

Your committee, to whom was referred a communication from J. T. Quick, of Niagara Falls, concerning his horse "Dominion Boy," can see no reason to change the action of the executive committee from any testimony in our possession; but wishing to do justice to Mr. Quick, would ask for further time to report.

A. J. DEAN,
A. O. HYDE,
Committee.

Time granted.

Bill was presented from John P. Allison, and on motion was referred to finance committee.

The finance committee reported as follows on the claim of Mr. Heaton for damages in changing booth grounds:

That there is no ground for such claim.

On the claim of Wm. H. Sotham for compensation for services rendered in soliciting exhibition of stock, that he be paid $25.

On the claim of the ladies of St. Paul's church, for pay for meal tickets, to pay the claim, $500.50, as presented.

Which several reports on motion were adopted.

Secretary Kimball offered the following resolutions, which were adopted:

Resolved, That the thanks of the executive committee are due and hereby tendered to the Detroit Tribune for its faithful and full reports of the proceedings of the winter meeting of this society, no other daily journal deeming it worth while to give the State Agricultural Society a hearing by publishing a report of its proceedings.

Resolved, That the thanks of the Executive Committee are hereby tendered R. F. Johnstone, Esq., of the *Michigan Farmer*, for being present and noting a synopsis of our proceedings for publication in his journal.

The Committee upon Constitution and By-Laws, through Mr. Baxter, reported as follows:

THE CHARTER AND CONSTITUTION OF THE MICHIGAN STATE AGRICULTURAL SOCIETY.

An act to incorporate the Michigan State Agricultural Society, approved March 31, 1849.

SECTION 1. *Be it enacted by the Senate and House of Representatives of the State of Michigan*, That all persons who now are, or may hereafter become associated for the purposes of this act, are hereby constituted a body corporate by the name of "The Michigan State Agricultural Society," for the purpose of promoting the improvement of agriculture and its kindred arts.

SEC. 2. For the purposes aforesaid, the society shall possess the general powers and privileges, and be subject to the general liabilities contained in chapter fifty-five, title ten, of the Revised Statutes of eighteen hundred and forty-six, so far as the same may be applicable and have not been modified or repealed; the real or personal estates which the said society shall be authorized to take, hold, and convey, over and above its library, and its scientific and agricultural collection, shall not, at any time, exceed in amount the value of twenty thousand dollars.

SEC. 3. It shall be the duty of the Michigan State Agricultural Society to transmit to the President of the Senate, for the use of the Legislature, in the month of January, *annually*, a report and statement of its proceedings, specifying the nature of the encouragement proposed by it, and the object for which, and persons to whom premiums have been awarded; embracing also such accurate details of the modes of civilization, of keeping stock, and other important incidents, as will acquaint farmers and others with the precise manner in which the valuable results recorded can be again obtained; and presenting such other matter as the society may judge most promotive of a greater and more general progress in practical agriculture.

SEC. 4. This act shall take effect immediately.

Your committee would respectfully report that after careful examination of the Constitution, they find that no printed form exists with all the amendments, as remembered by some of the members, and they have therefore prepared a final revision, and would recommend that the same be amended so as to read as follows:

THE CONSTITUTION.

ARTICLE 1. The name of this association shall be "The Michigan State Agricultural Society," and its object shall be to promote the improvement of agriculture and its kindred arts throughout the State of Michigan.

ART. 2. The officers of this Society shall be a President, a Recording Secretary, a Treasurer, and an Executive Committee of twenty members. At the annual meeting of the Society, to be held during the week of the fair, there shall be elected by a majority of the members present, a President, a Secretary, and a Treasurer, for one year, and ten members of the Executive Committee for two years, from the first of January next ensuing. All vacancies in the offices of the society shall be filled by the Executive Committee until the next election. If any member of the Executive Committee shall fail to attend two successive meetings of said committee, duly called, his place shall be deemed vacant. The ex-Presidents of this Society shall be also members of the Executive Committee.

ART. 3. County agricultural societies shall be auxiliaries of this Society, and the Presidents of such societies shall be *ex officio* Vice Presidents of this Society, and the Secretaries of such county societies, shall be *ex officio* Corresponding Secretaries of this Society.

ART. 4. The duties of the President, Vice President, Recording and Corresponding Secretary, shall be such as usually pertain to their respective offices, and such also as may be prescribed by the order of the Executive Committee, as hereafter provided.

ART. 5. The Treasurer shall receive and keep an accurate account of all moneys belonging to the Society; he shall pay out its moneys only on the order of the Executive Committee, and at each annual meeting of the Society he shall make a full report of its financial transactions and condition, and he shall give such official bond as the Executive Committee shall prescribe.

ART. 6. The Executive Committee shall determine the place for holding each annual meeting and fair of the Society, and it shall call that meeting and fair at such time as it shall judge best, or between the first Monday in September and the third Monday in October, giving at least sixty days' public notice thereof.

ART. 7. The Executive Committee shall direct the money appropriations of the

Society, and have the control of its property; it shall make the necessary preparations for the annual fair, and issue all proper public notices and circulars in relation thereto, or to the general object of the Society; it shall prepare the necessary By-Laws of the Society, and may prescribe such duties to the other officers of the Society as are not inconsistent with the usual business of their respective offices; it shall itself obey the instructions which may be given to it at the annual meeting of the Society, in matters not herein specially provided for, and at the expiration of its term of service shall make a full report of its proceedings. It shall be competent for the Executive Committee, or a majority of them, to appoint a Chairman and Secretary, who may transact all such business as they may be authorized to do by said committee; and said Secretary shall sign, and said Chairman countersign, all orders on the Treasurer for the payment of any money directed by said committee to be paid for any purpose, and said Secretary shall keep an accurate account of all orders so drawn.

ART. 8. It shall be the duty of the Executive Committee annually to regulate and award premiums on such articles, productions, and improvements as they may deem best calculated to promote the agricultural and household manufacturing interests of the State, having special reference to the most economical or popular mode of competition in raising the crops or stock, or in the fabrication of the articles offered: *Provided always*, When so required by the Executive Committee, that before any premium shall be delivered, the person claiming the same, or to whom the same shall be awarded, shall deliver to the President of the Society, in writing, an accurate statement and description, verified in such manner as the Executive Committee may direct, of the character of the soil, and the process in preparing it, including the quality and quantity of the manure applied in raising the crop, or the kind and quality of food in feeding the animal, as the case may be; also the kind and cost of labor employed, and the total expense and total productions of the crop, or the increase of value of the animal, with a view of showing accurately the exact resulting profit.

ART. 9. The Executive Committee shall meet annually, at such place as it may itself choose, on or before the second Monday in January, and shall then immediately prepare a report and abstract of the transactions of the Society during the preceding year, embracing such valuable reports from committees, statements of experiments, cultivation and improvement, proceedings of county societies, correspondence, statistics, and other matters, the publication of which will exhibit the condition of the agricultural interests of Michigan, and a diffused knowledge of which will, in the judgment of the committee, add to the productiveness of agricultural and household labor, and therefore promote the general prosperity of the State; and as soon as practicable the committee shall transmit such report and abstract to such office or officer as is required by the statutes of Michigan.

ART. 10. No officer of the Society except the Recording Secretary shall receive any compensation for his services. The Executive Committee shall allow said Secretary such sum for past and future services as they may deem advisable.

ART. 11. Any person may become a member of the Michigan State Agricultural Society for one year by paying into the treasury the sum of one dollar.

ART. 12. The Executive Committee may appoint sub-committees, with such duties and powers as said Executive Committee may prescribe.

ART. 13. This constitution may be altered or amended at any annual meeting of the Society, by a vote of two-thirds of the members present, provided such alteration or amendment shall have been recommended by a vote of two-thirds of the Executive Committee at their preceding annual meeting, and shall have been published in the premium list of that year.

BY-LAWS.

I.

There shall be appointed at the annual meeting of the Executive Committee, the following standing committees:

1. Business Committee.
2. Finance Committee.
3. Committee on Premium List.
4. Committee on Rules and Regulations.
5. Committee on Transportation.
6. Committee on Printing.

Which committees shall be composed only of the members appointed thereon.

II.

The President of the Society shall act as chairman of the Executive Committee, unless otherwise ordered.

III.

The Secretary of the Society shall act as Secretary of the Executive Committee, unless otherwise ordered.

IV.

The Chairman of the Executive Committee shall appoint all sub-committees of the Executive Committee, unless otherwise ordered.

V.

No pecuniary consideration or inducement, other than the premiums offered, shall be paid to exhibitors entering for premiums.

VI.

Any protest to award of Viewing Committee must be in writing, and must state particularly the grounds of protest, which must be for some cause other than errors of judgment on the part of the committee. Such protest must be filed with the Secretary, on or before the last day of the fair.

VII.

When a protest is regularly made, the same shall be referred to a special committee, whose duty it shall be to ascertain and report the facts to the Executive Committee; which statement of facts so reported shall be deemed final, and upon which facts the Executive Committee shall determine the law of the case.

VIII.

Any waiver by exhibitors of any requirement, as made in printed premium list, must be in writing and signed by the exhibitors.

IX.

All moneys received by the officers or by members of the Executive Committee for the society, shall, as soon as practicable, be paid to the Treasurer, and his receipt given therefor; and no moneys shall be paid out for the Society except by the Treasurer on proper orders drawn on him for the purpose. Each order so drawn shall show the specific object for which the same was drawn.

X.

No orders other than for premiums duly awarded shall be drawn on the Treasurer except on accounts duly audited and allowed by the Business Committee, and such allowance endorsed thereon by a majority of said committee. An appeal may be taken from the action of the Business Committee on accounts, to the Executive Committee.

XI.

It shall be the duty of the Business Committee to carry out the instructions of the Executive Committee in relation to the pecuniary affairs of the society, and in preparation for and holding fairs. They shall keep a record of all accounts allowed and orders drawn, and shall make a full report of all their doings to the Executive Committee at its annual meeting.

XII.

The Business Committee shall, under instructions from the Executive Committee, have general charge of the property of the Society (other than moneys in the Treasury), and shall properly care for the same and annually report the amount, situation, and condition of the same.

Judge Ramsdell moved an amendment that the official life of an ex-President as a member of the Executive Committee be limited to five years from the date

of the expiration of his term of office, provided that this amendment shall only affect those Presidents hereafter to be elected. Rejected.

The report was adopted, and the Constitution ordered to be printed in the premium list for 1875, and submitted to the next annual meeting of the society.*

The Finance Committee, to whom was referred the bill of John P. Allison, reported favorably, and on motion the bill was ordered paid, amounting to $100.

On motion, the vote by which an allowance of $150 was made Wm. Smith, of Detroit, was reconsidered, and after discussion the original motion was adopted by 16 ayes to 2 nays.

Moved by Mr. Greene that Mr. Sprague, also an exhibitor of fat cattle, be allowed $100 as a drawback; which motion, after discussion, was withdrawn.

Moved by Mr. Allison to pay the East Saginaw Driving Park Association one hundred dollars, in full of all demands of said Association, for booth rents collected or uncollected. Lost.

Mr. Sterling offered the following resolution, which on motion was adopted:

Resolved, That the Secretary be and is hereby allowed fifty (50) dollars per year for office rent, for the years 1873, 1874, and 1875, to reimburse him for fuel and lights for the Secretary's office.

Moved by Mr. Greene that the vote upon the resolution offered by Mr. Baxter in regard to committeemen in Divisions A, B, C, and D, be reconsidered. Lost.

Moved by Mr. Baxter that Divisions E and F be referred to the superintendents in charge to act as a committee, who shall appoint viewing committees under same regulations as in Divisions A, B, C, and D.

Divisions G, H, and I, to superintendents to appoint in same manner.

Divisions I, J, and K, to superintendents in charge in same manner.

Adopted.

Mr. Allison offered the following resolution, which was adopted:

Resolved, That President E. O. Humphrey and A. J. Dean constitute the committee in charge of printing and advertising for the current year.

It was moved and adopted that the next fair of the Society commence on Monday, the 13th day of September, and close on Friday, the 17th.

The following resolution was offered by Mr. Sterling, and adopted:

Resolved, That the Secretary advise Henry Fralick and others of the amount due the Michigan State Agricultural Society on bond of indemnity given us at Eaton Rapids, and that they be requested to pay the same to A. J. Dean, Treasurer.

Moved and adopted that the thanks of the Executive Committee be and are hereby tendered to Mrs. Hodges, and Mr. Forsyth, of the Hodges House, for the entertainment of the Committee, and to the citizens of Pontiac for their courtesies to them.

The following resolution, offered by Mr. Baxter, was adopted:

Resolved, That the thanks of this Committee be especially tendered to the able and efficient Secretary of this Society, C. F. Kimball, for his valuable services in advancing the interests of the Michigan State Agricultural Society.

The President appointed the following standing committees:

Business Committee—J. M. Sterling, Monroe; N. L. Avery, Grand Rapids; A. O. Hyde, Marshall.

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* The printing of the foregoing report in premium list 1875, in accordance with this order, was dispensed with by order of the Business and Printing Committee.—SECRETARY.

EXECUTIVE SUPERINTENDENTS.

General Superintendent—W. G. Beckwith, Cassopolis.
Superintendent of Cattle—G. W. Phillips, Romeo.
Superintendents of Horses—A. O. Hyde, Marshall; D. W. Howard, Pentwater.
Superintendents of Sheep and Swine—E. W. Rising, Davison; D. W. Blodget, Hersey.
Superintendent of Poultry and Miscellaneous—J. P. Allison, East Saginaw.
Superintendents of Farm Implements—H. O. Hanford, Plymouth; Abel Angel, Bradley.
Superintendents of Art Hall—J. W. Childs, Ypsilanti; J. G. Ramsdell, Grand Traverse.
Superintendent of Music Hall—C. L. Whitney, Muskegon.
Superintendents of Manufacturing Hall—N. L. Avery, Grand Rapids; J. Q. A. Burrington, Worth.
Superintendents of Machinery Hall—Wm. M. Ferry, Grand Haven; Charles Kipp, St. Johns.
Superintendent of Agricultural Hall—E. Phelps, Pontiac.
Superintendent of Carriage Hall—G. W. Griggs, Grand Rapids.
Superintendent of Booths—F. M. Manning, Paw Paw.
Superintendents of Police and Gates—J. M. Sterling, Monroe; A. J. Dean, Adrian.
Superintendents of Transportation—W. J. Baxter, Jonesville; J. M. Sterling, Monroe.
Chief Marshal—C. W. Greene, Farmington.
Superintendent of Forage—E. W. Rising, Davison Station.
Superintendent of Grand Stand—G. C. Monroe, Jonesville.
Centennial Committee—W. J. Baxter, J. G. Ramsdell, J. W. Childs, Wm. M. Ferry, C. F. Kimball.

Mr. Baxter offered the following resolution, which was adopted:

Resolved, That all dinner tickets, exhibitors' tickets, and entrance tickets, furnished to the Executive Committee, shall be charged to them respectively, and such tickets as are not used shall be credited to them, and the Treasurer shall report to the Executive Committee the state of the account with each member.

Adjourned *sine die*.

LIST OF PREMIUMS.

The following list of premiums, to be offered at the Fair of 1875, was reported from the committee, and adopted Jan. 14, 1875:

DIVISION A—CATTLE.

A—CLASS 1.—SHORTHORNS.

Superintendent—George W. Phillips, Romeo.

Best bull, four years old or over	$40 00
Second best bull, four years old or over	20 00
Third best bull, four years old or over	10 00
Best bull, three years old	30 00
Second best bull, three years old	15 00
Third best bull, three years old	8 00
Best bull, two years old	20 00
Second best bull, two years old	10 00
Third best bull, two years old	5 00
Best bull, one year old	10 00
Second best bull, one year old	5 00
Third best bull, one year old	3 00
Best bull calf	10 00
Second best bull calf	5 00
Third best bull calf	3 00
Best bull of any age	Diploma

Best cow, four years old or over	$10 00
Second best cow, four years old or over	20 00
Third best cow, four years old or over	10 00
Best heifer, three years old	30 00
Second best heifer, three years old	15 00
Third best heifer, three years old	8 00
Best heifer, two years old	15 00
Second best heifer, two years old	8 00
Third best heifer, two years old	3 00
Best yearling heifer	10 00
Second best yearling heifer	5 00
Third best yearling heifer	3 00
Best heifer calf	10 00
Second best heifer calf	5 00
Third best heifer calf	3 00

NOTE TO EXHIBITORS.—The exhibitor shall be required to exhibit a pedigree of the animal competing, and the winner of the premiums must file with the Secretary a copy of the pedigree of the animal which was the successful competitor. Where all other points are equal, the committee is to be guided by the condition of the animal for breeding purposes. The pedigree must show descent on both sides from imported stock. Directness of descent and an acknowledged celebrity of ancestry to rule in the comparison of pedigree. Quality of animal and fitness for breeding, with justness of proportion, to be considered next after establishing purity of blood. This rule applies to all the improved breeds of cattle.

The entry of young stock in the appropriate section does not preclude them being shown with their sire or dam.

A—CLASS 2—DEVONS.

Best bull, four years old or over	$40 00
Second best bull, four years old or over	20 00
Third best bull, four years old or over	10 00
Best bull, three years old	30 00
Second best bull, three years old	15 00
Third best bull, three years old	8 00
Best bull, two years old	20 00
Second best bull, two years old	10 00
Third best bull, two years old	5 00
Best bull, one year old	10 00
Second best bull, one year old	5 00
Third best bull, one year old	3 00
Best bull calf	10 00
Second best bull calf	5 00
Third best bull calf	3 00
Best bull of any age	Diploma
Best cow, four years old or over	$40 00
Second best cow, four years old or over	20 00
Third best cow, four years old or over	10 00
Best heifer, three years old	30 00
Second best heifer, three years old	15 00
Third best heifer, three years old	8 00
Best heifer, two years old	15 00
Second best heifer, two years old	8 00
Third best heifer, two years old	3 00
Best yearling heifer	10 00
Second best yearling heifer	5 00
Third best yearling heifer	3 00
Best heifer calf	10 00
Second best heifer calf	5 00
Third best heifer calf	3 00

A—CLASS 3—HEREFORDS.

Best bull, four years old or over	$10 00
Second best bull, four years old or over	20 00
Third best bull, four years old or over	10 00
Best bull, three years old or over	30 00

Second best bull, three years old or over	$15 00
Third best bull, three years old or over	8 00
Best bull, two years old	20 00
Second best bull, two years old	10 00
Third best bull, two years old	5 00
Best bull, one year old	10 00
Second best bull, one year old	5 00
Third best bull, one year old	3 00
Best bull calf	10 00
Second best bull calf	5 00
Third best bull calf	3 00
Best bull of any age	Diploma
Best cow, four years old or over	$40 00
Second best cow, four years old or over	20 00
Third best cow, four years old or over	10 00
Best heifer, three years old	30 00
Second best heifer, three years old	15 00
Third best heifer, three years old	8 00
Best heifer, two years old	15 00
Second best heifer, two years old	8 00
Third best heifer, two years old	3 00
Best heifer, one year old	10 00
Second best heifer, one year old	5 00
Third best heifer, one year old	3 00
Best heifer calf	10 00
Second best heifer calf	5 00
Third best heifer calf	3 00

A—CLASS 4.—AYRSHIRES.

Best bull, four years old	$30 00
Second best bull, four years old	20 00
Third best bull, four years old	10 00
Best bull, three years old	20 00
Second best bull, three years old	10 00
Third best bull, three years old	7 00
Best bull, two years old	10 00
Second best bull, two years old	5 00
Third best bull, two years old	3 00
Best bull, one year old	8 00
Second best bull, one year old	4 00
Third best bull, one year old	2 00
Best bull calf	4 00
Second best bull calf	2 00
Best bull of any age	Diploma
Best cow, four years old	$30 00
Second best cow, four years old	20 00
Third best cow, four years old	10 00
Best cow, three years old	20 00
Second best cow, three years old	10 00
Third best cow, three years old	7 00
Best heifer, two years old	10 00
Second best heifer, two years old	5 00
Third best heifer, two years old	3 00
Best heifer, one year old	8 00
Second best heifer, one year old	4 00
Third best heifer, one year old	2 00
Best heifer calf	4 00
Second best heifer calf	2 00

A—CLASS 5.—ALDERNEYS.

Committee will be same as Class 4 (Ayrshires).

Best bull, four years old	$30 00
Second best bull, four years old	20 00
Third best bull, four years old	10 00
Best bull, three years old	20 00

Second best bull, three years old	$10 00
Third best bull, three years old	7 00
Best bull, two years old	10 00
Second best bull, two years old	5 00
Third best bull, two years old	3 00
Best bull, one year old	8 00
Second best bull, one year old	4 00
Third best bull, one year old	2 00
Best bull calf	4 00
Second best bull calf	2 00
Best bull of any age	Diploma
Best cow, four years old	$30 00
Second best cow, four years old	20 00
Third best cow, four years old	10 00
Best cow, three years old	20 00
Second best cow, three years old	10 00
Third best cow, three years old	7 00
Best heifer, two years old	10 00
Second best heifer, two years old	5 00
Third best heifer, two years old	3 00
Best heifer, one year old	8 00
Second best heifer, one year old	4 00
Third best heifer, one year old	2 00
Best heifer calf	4 00
Second best heifer calf	2 00

A—CLASS 6.—GALLOWAYS.

Best bull, four years old	$30 00
Second best bull, four years old	20 00
Third best bull, four years old	10 00
Best bull, three years old	20 00
Second best bull, three years old	10 00
Third best bull, three years old	7 00
Best bull, two years old	10 00
Second best bull, two years old	5 00
Third best bull, two years old	3 00
Best bull, one year old	8 00
Second best bull, one year old	4 00
Third best bull, one year old	2 00
Best bull calf	4 00
Second best bull calf	2 00
Best bull of any age	Diploma
Best cow, four years old	$30 00
Second best cow, four years old	20 00
Third best cow, four years old	10 00
Best cow, three years old	20 00
Second best cow, three years old	10 00
Third best cow, three years old	7 00
Best heifer, two years old	10 00
Second best heifer, two years old	7 00
Third best heifer, two years old	2 00
Best heifer calf	4 00
Second best heifer calf	2 00

A—CLASS 7.—GRADE AND NATIVE CATTLE.

Best grade or native cow, four years or over	$20 00
Second best grade or native cow, four years or over	10 00
Third best grade or native cow, four years or over	5 00
Best heifer, three years old	15 00
Second best heifer, three years old	7 00
Third best heifer, three years old	4 00
Best heifer, two years old	10 00
Second best heifer, two years old	5 00
Best yearling heifer	8 00
Second best yearling heifer	5 00

Best heifer calf	$5 00
Second best heifer calf	3 00
Best bull of any age	Diploma

All native cows rank as grades.

A—CLASS 8.—WORKING OXEN AND STEERS.

Best yoke of working oxen, five years and over	$25 00
Second best yoke of working oxen, five years and over	20 00
Third best yoke of working oxen, five years and over	15 00
Best yoke of steers, four years old	15 00
Second best yoke of steers, four years old	10 00
Third best yoke of steers, four years old	7 00
Best yoke of steers, three years old	10 00
Second best yoke of steers, three years old	7 00
Third best yoke of steers, three years old	5 00
Best yoke of steers, two years old	8 00
Second best yoke of steers, two years old	5 00
Third best yoke of steers, two years old	3 00
Best yoke of steers, one year old	5 00
Second best yoke of steers, one year old	3 00
To the trainer of best exhibition of trained stock	5 00

The working oxen, five years old and over, will be tested to draft in such manner as the committee may direct, for the purpose of proving their quality as working stock.

The trained cattle are to show as competent for actual service on the road or field. Mere "fancy" training in the yard is not what the Society desires to promote.

A—CLASS 9.—FAT CATTLE.

Awarding committee to be appointed on the grounds.

Best herd of cattle, four in number	$75 00
Second best herd of cattle, four in number	50 00
Best pair of fat oxen	30 00
Second best pair of fat oxen	20 00
Best fat ox	15 00
Second best fat ox	10 00
Best fat cow	15 00
Second best fat cow	10 00
Best steer, three years old	10 00
Second best steer, three years old	5 00
Best heifer, three years old	10 00
Second best heifer, three years old	5 00
Best steer, two years old	6 00
Best heifer, two years old	6 00

A—CLASS 10.—HERDS AND SWEEPSTAKES.

Awarding committee to be appointed on the grounds. Herd No. 1—Premiums $280 00.

For herds of thoroughbred cattle of one bull over one year old, and not less than four cows or heifers, the exhibitor must have owned the whole herd at least three months previous to the fair. In judging the different ages, from five year old and over cows to calves, the best for age shall have the preference over aged cows or numbers.

First premium	$100 00
Second premium	80 00
Third premium	60 00
Fourth premium	40 00

Herd No. 2—$20 00.

Best herd of five head of grade stock, any thoroughbred bull without regard to dam	20 00

DIVISION B—HORSES.

Superintendents—A. O. Hyde, Marshall, D. W. Howard, Pentwater.

B—CLASS 11.—THOROUGHBREDS.

Best stallion, four years old or over	$50 00
Second best stallion, four years old or over	25 00
Third best stallion, four years old or over	15 00

Best stallion, three years old	$20 00
Second best stallion, three years old	15 00
Third best stallion, three years old	10 00
Best stallion, two years old	12 00
Second best stallion, two years old	8 00
Third best stallion, two years old	5 00
Best stallion, one year old	10 00
Second best stallion, one year old	6 00
Third best stallion, one year old	4 00
Best brood mare, four years old or over, with foal by her side	20 00
Second best brood mare, four years old or over, with foal by her side	15 00
Third best brood mare, four years old or over, wirh foal by her side	10 00
Best mare, four years old or over, without colt	15 00
Second best mare, four years old or over, without colt	12 00
Third best mare, four years old or over, without colt	8 00
Best three year old filly	12 00
Second best three year old filly	8 00
Third best three year old filly	5 00
Best two year old filly	10 00
Second best two year old filly	6 00
Third best two year old filly	4 00
Best yearling filly	7 00
Second best yearling filly	5 00
Third best yearling filly	3 00
Best gelding, four years old	12 00
Second best gelding, four years old	8 00
Best gelding, three years old	10 00
Second best gelding, three years old	5 00
Best gelding, two years old	8 00
Second best gelding, two years old	5 00

The competitors who enter thoroughbred horses will note:

First, That the judges will be required to reject any animal whose pedigree is not authenticated and which cannot be traced back without flaw on either side of sire or dam, to well known English or American thoroughbred stock.

Second, Soundness, symmetry, and size, as well as the utility of the recorded animal for improving the stock of horses in this State, should be considered. The pedigree settles the question as to blood and breeding.

If the stallion can be accompanied by any number of his colts, of any age, to show his quality as a stock horse, so much the better.

B—CLASS 12.—HORSES OF ALL WORK.

Best stallion, five years old or over	$50 00
Second best stallion, five years old or over	25 00
Third best stallion, five years old or over	15 00
Best stallion, four years old	30 00
Second best stallion, four years old	15 00
Third best stallion, four years old	10 00
Best stallion or gelding, three years old	20 00
Second best stallion or gelding, three years old	15 00
Third best stallion or gelding, three years old	10 00
Best stallion or gelding, two years old	12 00
Second best stallion or gelding, two years old	8 00
Third best stallion or gelding, two years old	5 00
Best stallion or gelding, one year old	10 00
Second best stallion or gelding, one year old	6 00
Third best stallion or gelding, one year old	4 00
Best brood mare, four years old or over, with foal by her side	20 00
Second best brood mare, four years old or over, with foal by her side	15 00
Third best brood mare, four years old or over, with foal by her side	10 00
Best mare, four years old or over, without colt	12 00
Second best mare, four years old or over, without colt	8 00
Third best mare, four years old or over, without colt	5 00
Best mare, three years old	12 00
Second best mare, three years old	8 00
Third best mare, three years old	5 00
Best filly, two years old	10 00

Second best filly, two years old	$6 00
Third best filly, two years old	4 00
Best filly, one year old	7 00
Second best filly, one year old	5 00
Third best filly, one year old	3 00
Best gelding, four years old	12 00
Second best gelding, four years old	8 00
Third best gelding, four years old	5 00
Best pair of matched horses of all work, five years old or over, speed, size, style, and fitness for carriage or farm work to be the points; weight of each horse to be not less than 1,100 pounds	50 00
Second best pair of matched horses of all work, five years old or over, speed, size, style, and fitness for carriage or farm work to be the points; weight of each horse to be not less than 1,100 pounds	25 00
Third best pair of matched horses of all work, five years old or over, speed, size, style, and fitness for carriage or farm work to be the points; weight of each horse to be not less than 1,100 pounds	15 00
Best pair of four year old horses, matched in color, speed, size, style, and fitness for carriage or farm work	30 00
Second best pair of four year old horses, matched in color, speed, size, style, and fitness for carriage or farm work	15 00
Third best pair of four year old horses, matched in color, speed, size, style, and fitness for carriage or farm work	10 00
Best pair of matched horses, for all work, three years old	15 00
Second best pair of matched horses, for all work, three years old	10 00
Third best pair of matched horses, for all work, three years old	5 00

RULE.—All entries in this class, where weight is one of the conditions, shall be accompanied with a reliable certificate of date, not exceeding one week previous to the opening of the exhibition showing satisfactorily the weight of the animals that are entered for competition.

The "horse of all work" (breeding stock) should not be less than 15½ hands in height, nor less than 1,100 pounds in weight, quick, lively ears, broad between the eyes, round barrel, short loins, well up in the shoulders, deep chested, square quarters, flat legs, short between knee and pastern, hind legs well under him, speed equal to eight miles an hour on the road, and at least three miles at the plow, with sufficient blood to ensure spirit, style, and endurance, as in this class it is evident the mature animals are intended for breeding, they should be sound; and as the young animals must be judged on their own merits, as well as their promise for future usefulness, they also must be sound or else they cannot compete. The "horse of all work" is intended to be capable of being trained for the saddle, for harness, and to be able to go on the road or in draught, as he may chance to be broken. It may be that the "horse of all work" shall, after a few years' training, make a useful, spirited, handsome family roadster, or he may be brought up to be a good draught horse, true to pull to any load that may be put behind him. Much depends on the use he is put to. Hence the judges will note that he is not to be judged by the speed he may make for a single mile. Hence, also, it will be noted that he may be thoroughbred or he may not, and for the same reason he must have size, action, and spirit, as well as constitution, if he is worthy of a premium as a breeding animal.

The Executive Committee have decided that a mare may show as many colts as her owner desires, to prove her quality as a dam, but one of these colts must be the produce of the year of the exhibition.

B—CLASS 13.—ROADSTERS.

Best stallion, five years old or over	$50 00
Second best stallion, five years old or over	25 00
Third best stallion, five years old or over	15 00
Best stallion, four years old	30 00
Second best stallion, four years old	15 00
Third best stallion, four years old	10 00
Best gelding, five years old	20 00
Second best gelding, five years old	15 00
Third best gelding, five years old	10 00
Best stallion or gelding, three years old	20 00
Second best stallion or gelding, three years old	15 00
Third best stallion or gelding, three years old	10 00

Best stallion or gelding, two years old	$12 00
Second best stallion or gelding, two years old	8 00
Third best stallion or gelding, two years old	5 00
Best yearling stallion or gelding	10 00
Second best yearling stallion or gelding	6 00
Third best yearling stallion or gelding	4 00
Best brood mare, four years old or over, with foal by her side	20 00
Second best brood mare, four years old or over, with foal by her side	15 00
Third best brood mare, four years old or over, with foal by her side	10 00
Best mare, four years old or over, without colt	12 00
Second best mare, four years old or over, without colt	8 00
Third best mare, four years old or over, without colt	5 00
Best mare, three years old	10 00
Second best mare, three years old	6 00
Third best mare, three years old	4 00
Best mare, two years old	8 00
Second best mare, two years old	5 00
Third best mare, two years old	3 00
Best mare, one year old	8 00
Second best mare, one year old	5 00
Third best mare, one year old	3 00

RULE.—All exhibitors in Class 12 shall bring with the entry a copy of certificate of breeding, which shall be filed with the Secretary, and which shall be put on record in all cases where premiums are awarded. No horse will be ruled out for want of certificate, where breeding cannot be established; but a well authenticated pedigree will be considered a favorabe point, all others being equal.

B—CLASS 14.—GENTLEMEN'S DRIVING HORSE TO ROAD WAGONS.

Best pair of driving horses, owned and driven by the exhibitor for thirty days previous to the fair, not used for sporting purposes, to be exhibited under the direction of the Superintendents in charge of department	$50 00
Second best pair of driving horses, owned and driven by the exhibitor for thirty days previous to the fair, not used for sporting purposes, to be exhibited under the direction of the superintendents in charge of department	30 00
Third best pair of driving horses, owned and driven by the exhibitor for thirty days previous to the fair, not used for sporting purposes, to be exhibited under the direction of the Superintendent in charge of department	20 00
Best single gelding or mare, five years old or over	30 00
Second best single gelding or mare, five years old or over	20 00
Third best single gelding or mare, five years old or over	10 00
Best four year old single mare or gelding	20 00
Second best four year old single mare or gelding	15 00
Third best four year old single mare or gelding	10 00

The committee will test all animals entered in this class, under such rules as may be deemed necessary to determine the merits of the competitors, it being understood that speed is not to be the sole test.

RULE.—All horses shown in this class shall be driven by the owners, and must have been owned and driven by them for thirty days previous to the entry for exhibition, and not used for sporting purposes.

NOTE.—The viewing committee are to understand that it is the design of the Society to make it clear that only gentlemen's roadsters can be permitted to compete, and that any two horses that may be harnessed together for the occasion, are not a driving team in the meaning of the premium list.

B—CLASS 15.—DRAUGHT HORSES.

Best stallion, four years old or over	$50 00
Second best stallion, four years old or over	30 00
Third best stallion, four years old or over	20 00
Best stallion, three years old	30 00
Second best stallion three years old	20 00
Third best stallion, three years old	10 00
Best stallion, two years old	20 00
Second best stallion, two years old	15 00
Third best stallion, two years old	10 00
Best colt, one year old	15 00
Second best colt, one year old	10 00

Third best colt, one year old	$5 00
Best sucking colt	8 00
Second best sucking colt	5 00
Third best sucking colt	3 00
Best mare, four years old or over	50 00
Second best mare, four years old or over	30 00
Third best mare, four years old or over	20 00
Best imported draft stallion, of any breed, or those bred from imported sire and dam, four years old and over	50 00
Second best imported draft stallion, of any breed, or those bred from imported sire and dam, four years old and over	30 00
Third best imported draft stallion, of any breed, or those bred from imported sire and dam, four years old and over	20 00

NOTE.—Horses exhibited in the above class must weigh not less than 1,300 pounds, if four years old or over.

SPECIAL DRAFT TEST PREMIUMS.

SWEEPSTAKES PREMIUMS—DRAFT HORSES.

Best span of draft horses, to weigh not less than 1,400 pounds each, to pull loaded sled or boat	$50 00
Second best span of draft horses, to weigh not less than 1,400 pounds each, to pull loaded sled or boat	25 00
Best span of draft horses, under 1,400 pounds each, to pull loaded sled or boat	50 00
Second best span of draft horses, under 1,400 pounds each, to pull loaded sled or boat	25 00

The sled or boat must be drawn in a straight line not less than eight feet. Persons entering in this class must present the committee a certificate of the weight of each horse.

B—CLASS 16.—CARRIAGE AND BUGGY HORSES.

Best pair of matched carriage horses, sixteen hands or over, and five years old or over	$50 00
Second best pair of matched carriage horses, sixteen hands or over, and five years old or over	25 00
Third best pair of matched carriage horses, sixteen hands or over, and five years old or over	15 00
Best pair of matched carriage horses, sixteen hands or over, and four years old	30 00
Second best pair of matched carriage horses, sixteen hands or over, and four years old	15 00
Third best pair of matched carriage horses, sixteen hands or over, and four years old	10 00
Best pair of matched carriage horses, under sixteen hands, and four years old or over	40 00
Second best pair of matched carriage horses, under sixteen hands, and four years old or over	20 00
Third best pair of matched carriage horses, under sixteen hands, and four years old or over	10 00
Best pair of matched carriage horses, three years old	25 00
Second best pair of matched carriage horses, three years old	15 00
Third best pair of matched carriage horses, three years old	10 00
Best single carriage or buggy horse or mare, four years old or over	15 00
Second best single carriage or buggy horse or mare, four years old or over	10 00
Best single carriage or buggy horse or mare, three years old	10 00
Second best single carriage or buggy horse or mare, three years old	5 00

RULE.—All Horses in this class shall be measured by a standard on the ground, and by the committee, and speed shall not be considered the sole test of merit. The several points of form, general beauty, style, action, matching, and evenness of gait, are to be considered.

B—CLASS 17.—SADDLE HORSES.

Best saddle horse	$20 00
Second best saddle horse	15 00
Third best saddle horse	10 00

B—CLASS 18.—JACKS AND MULES.

Best Spanish or Maltese Jack, which has been kept in the State for service not less than three months previous to the exhibition, and has been proved a good stock-getter	$30 00
Second best Spanish or Maltese Jack, which has been kept in the State for service not less than three months previous to the exhibition, and has been proved a good stock-getter	15 00
Best young jack, not less than one year nor more than three years old, bred in Michigan	10 00
Best jenny, with foal at her side	8 00
Second best jenny, with foal at her side	6 00
Best pair of aged mules	10 00
Second best pair of aged mules	5 00
Best show of young mules, taking number and quality into consideration, bred from one jack, not less than five in number, of any age	20 00

DIVISION C—SHEEP AND SWINE.

Superintendents—E. W. Rising, Davison Station, Genesee; D. A. Blodgett, Hersey, Osceola.

All ewes, three years old or over, exhibited in Classes Nos. 18, 19, 20 and 21, are required to have bred a lamb during the present year, and all sheep shall be entered and compete in one class only. Pens shall consist of three in number, unless otherwise specified.

C—CLASS 19.—AMERICAN MERINOS.

Best buck, two years old or over	$25 00
Second best buck, two years old or over	20 00
Third best buck, two years old or over	15 00
Best buck, one year old	20 00
Second best buck, one year old	15 00
Third best buck, one year old	10 00
Best three buck lambs	12 00
Second best three buck lambs	8 00
Third best three buck lambs	6 00
Best three ewes, two years old or over	25 00
Second best three ewes, two years old or over	15 00
Third best three ewes, two years old or over	10 00
Best three ewes, one year old	20 00
Second best three ewes, one year old	15 00
Third best three ewes, one year old	10 00
Best three ewe lambs	12 00
Second best three ewe lambs	8 00
Third best three ewe lambs	6 00

C—CLASS 20.—SOUTH-DOWN AND OTHER MIDDLE-WOOLED SHEEP.

NOTE.—All middle-wooled sheep shall compose and compete in this class.

Best buck, two years old or over	$20 00
Second best buck, two years old or over	10 00
Third best buck, two years old or over	5 00
Best yearling buck	10 00
Second best yearling buck	5 00
Third best yearling buck	3 00
Best pen of buck lambs	10 00
Second best pen of buck lambs	6 00
Third best pen of buck lambs	3 00
Best three ewes, two years old or over	20 00
Second best three ewes, two years old or over	10 00
Third best three ewes, two years old or over	5 00
Best three ewes, one year old	12 00
Second best three ewes, one year old	6 00
Third best three ewes, one year old	4 00
Best three ewe lambs	10 00
Second best three ewe lambs	5 00
Third best three ewe lambs	3 00

C—CLASS 21—COTSWOLD, LEICESTER, AND OTHER LONG-WOOLED SHEEP.

NOTE.—All long-wooled sheep compete in this class.

Best buck, two years old or over	$20 00
Second best buck, two years old or over	10 00
Third best buck, two years old or over	5 00
Best yearling buck	10 00
Second best yearling buck	5 00
Third best yearling buck	3 00
Best pen of three buck lambs	10 00
Second best pen of three buck lambs	6 00
Third best pen of three buck lambs	3 00
Best three ewes, three years old or over	20 00
Second best three ewes, three years old or over	10 00
Third best three ewes, three years old or over	5 00
Best three ewes, two years old	16 00
Second best three ewes, two years old	8 00
Third best three ewes, two years old	4 00
Best three ewes, one year old	12 00
Second best three ewes, one year old	8 00
Third best three ewes, one year old	4 00
Best three ewe lambs	10 00
Second best three ewe lambs	5 00
Third best three ewe lambs	3 00

C—CLASS 22.—FAT SHEEP.

Best pen of five fat sheep	$15 00
Second best pen of five fat sheep	10 00
Third best pen of five fat sheep	6 00

C—CLASS 23.—SWINE.

Berkshire.

Best boar, two years old or over	$12 00
Second best boar, two years old or over	8 00
Third best boar, two years old or over	4 00
Best boar, one year old	10 00
Second best boar, one year old	6 00
Third best boar, one year old	3 00
Best sow, two years or over	12 00
Second best sow, two years or over	8 00
Third best sow, two years or over	4 00
Best sow, one year old	10 00
Second best sow, one year old	6 00
Third best sow, one year old	3 00
Best pen of pigs, not less than four in number, nor over ten months old	10 00
Second best pen of pigs, not less than four in number, nor over ten months old	6 00
Third best pen of pigs, not less than four in number, nor over ten months old	3 00

Essex.

Best boar, two years old or over	$12 00
Second best boar, two years old or over	8 00
Third best boar, two years old or over	4 00
Best boar, one year old	10 00
Second best boar, one year old	6 00
Third best boar, one year old	3 00
Best sow, two years or over	12 00
Second best sow, two years or over	8 00
Third best sow, two years or over	4 00
Best sow, one year old	10 00
Second best sow, one year old	6 00
Third best sow, one year old	3 00
Best pen of pigs, not less than four in number, nor over ten months old	10 00
Second best pen of pigs, not less than four in number, nor over ten months old	6 00
Third best pen of pigs, not less than four in number, nor over ten months old	3 00

Suffolk.

Best boar, two years old or over	$12 00
Second best boar, two years old or over	8 00
Third best boar, two years old or over	4 00
Best boar, one year old	10 00
Second best boar, one year old	6 00
Third best boar, one year old	3 00
Best sow, two years old or over	12 00
Second best sow, two years old or over	8 00
Third best sow, two years old or over	4 00
Best sow, one year old	10 00
Second best sow, one year old	6 00
Third best sow, one year old	3 00
Best pen of pigs, not less than four in number, nor over ten months old	10 00
Second best pen of pigs, not less than four in number, nor over ten months old	6 00
Third best pen of pigs, not less than four in number, nor over ten months old	3 00

Fat Hogs.

Best hog, over one year old	$10 00
Second best hog, over one year old	6 00
Third best hog, over one year old	3 00
Best pig, less than ten months old	6 00
Second best pig, less than ten months old	4 00
Third best pig, less than ten months old	2 00

The Committee will note that there are some breeds, such as the Lancashire, White, the Lincoln, the Yorkshire, and the Neapolitan, not mentioned by name, which are deserving of notice. Should any of these be offered for premiums, the exhibitor must be able to prove purity of blood and directness of descent, to the satisfaction of the committee, who may award discretionary premiums.

In case an award is made to a single individual of a litter, and the litter is entered for a premium, there must be four in number, without the one entered for a special premium, but the pig may not be ruled out of the litter otherwise, as the sow, as a breeder, is entitled to show the whole of her progeny, no matter what the number.

DIVISION D—POULTRY.

Superintendent—J. P. Allison, East Saginaw.

CLASS 24.—POULTRY.

For the best, most varied, and most valuable collection of Poultry, entered and owned by one exhibitor	$25 00

The Asiatic Class.

	Fowls.	Chickens.
Trio light brahmas	$2 00	$2 00
Second prize	1 00	1 00
Trio dark brahmas	2 00	2 00
Second prize	1 00	1 00
Trio buff cochins	2 00	2 00
Second prize	1 00	1 00
Trio partridge or grouse cochins	2 00	2 00
Second prize	1 00	1 00
Trio white cochins	2 00	2 00
Second prize	1 00	1 00

The Dorking Class.

	Fowls.	Chickens.
Trio colored dorkings, except silver gray	$2 00	$2 00
Second prize	1 00	1 00
Trio white dorkings	2 00	2 00
Second prize	1 00	1 00
Trio dominiques	2 00	2 00

The Game Class.

	Fowls.	Chickens.
Pair black-breasted red games	$2 00	$2 00
Second prize	1 00	1 00
Pair duck-wing games	2 00	2 00
Second prize	1 00	1 00
Pair blue games	2 00	2 00
Second prize	1 00	1 00
Pair white-legged Earl Derby games	2 00	2 00
Second prize	1 00	1 00

The Spanish Class.

	Fowls.	Chickens.
Trio black Spanish	$2 00	$2 00
Second prize	1 00	1 00
Trio white Leghorns (*yellow legs, single combs*)	2 00	2 00
Second prize	1 00	1 00

The Polish Class.

	Fowls.	Chickens.
Trio black Polish	$2 00	$2 00
Second prize	1 00	1 00
Trio white Polish (*white crests*)	2 00	2 00
Second prize	1 00	1 00
Trio silver Polish	2 00	2 00
Second prize	1 00	1 00
Trio golden Polish	2 00	2 00

The French Class.

	Fowls.	Chickens.
Trio Creve-cœurs	$2 00	$2 00
Second prize	1 00	1 00
Trio Houdans	2 00	2 00
Second prize	1 00	1 00
Trio La Fleche	2 00	2 00

The Hamburg Class.

	Fowls.	Chickens.
Trio golden spangled Hamburg	$2 00	$2 00
Second prize	1 00	1 00
Trio silver spangled Hamburg	2 00	2 00
Second prize	1 00	1 00

Miscellaneous Class.

	Fowls.	Chickens.
Trio Silkies	$2 00	$2 00
Second prize	1 00	1 00

The Bantam Class.

	Fowls.	Chickens.
Trio black-breasted red game Bantams	$2 00	$2 00
Second prize	1 00	1 00
Trio duck-wing game Bantams	2 00	2 00
Second prize	1 00	1 00
Trio silver-laced Sebright Bantams	2 00	2 00
Second prize	1 00	1 00
Trio gold-laced Sebright Bantams	2 00	2 00
Second prize	1 00	1 00
Trio black African Bantams	2 00	2 00
Second prize	1 00	1 00

The Turkey Class.

	Fowls.	Chickens.
Pair bronze turkeys	$2 00	$1 00
Pair white turkeys	2 00	1 00
Pair buff turkeys	2 00	1 00
Pair gray turkeys	2 00	1 00
Pair slate turkeys	2 00	1 00
Pair black turkeys	2 00	1 00
Pair pearl Guinea fowls	2 00	1 00
Pair white Guinea fowls	2 00	1 00

The Ornamental Class.

Pair peafowls	$2 00
Pair white peafowls	2 00
Pair English pheasants	2 00

The Goose Class.

Pair Toulouse geese	$3 00
Second prize	1 00
Pair Bremen geese	2 00
Second prize	1 00

The Duck Class.

Pair Rouen ducks	$2 00
Second prize	1 00
Pair Aylesbury ducks	2 00
Second prize	1 00
Pair Cayuga ducks	2 00
Second prize	1 00
Pair Topknot ducks	2 00
Second prize	1 00
Pair Musk or Muscovy ducks	2 00
Second prize	1 00

The Rabbit Class.

Best lop-eared rabbits, buck of any color	$2 00
Second best lop-eared rabbits, buck of any color	1 00
Best lop-eared rabbits, doe of any color	2 00
Second best lop-eared rabbits, doe of any color	1 00

The Pigeon Class.

For the best, most varied, and most valuable collection of pigeons, entered and owned by one exhibitor	$5 00
Pouters, best pair yellow-pied	1 00
Pouters, best pair black-pied	1 00
Pouters, best pair blue-pied	1 00
Pouters, best pair red-pied	1 00
Pouters, best pair white	1 00
Pouters, best pair of any color	1 00
Carriers, best pair black	2 00
Carriers, best pair white	2 00
Carriers, best pair blue	2 00
Carriers, best pair dun	2 00
Carriers, best pair yellow	2 00
Short-Faced Tumblers:	
Almond tumblers, best pair	1 00
Almond tumblers, best pair beards	1 00
Almond tumblers, best pair bald-heads	1 00
Almond tumblers, best pair mottles	1 00
Almond tumblers, best pair agates	1 00
Almond tumblers, best pair kites	1 00
Almond tumblers, best pair of any other color or marking	1 00
Fantails, best pair white	1 00
Fantails, best pair blue	1 00
Fantails, best pair red	1 00
Fantails, best pair yellow	1 00
Fantails, best pair black	1 00
Jacobins, best pair	1 00
Runts, "	1 00
Turbits, "	1 00
Swallows, "	1 00
Trumpeters, "	1 00
Spots, "	1 00
Nuns, "	1 00

Priests, best pair	$1 00
Helmets, "	1 00
Laughers, "	1 00
Archangels, "	1 00
Starlings, "	1 00
Magpies, "	1 00
Owls, best pair black	1 00
Owls, best pair white	1 00
Owls, best pair blue	1 00
Owls, best pair red	1 00
Owls, best pair yellow	1 00
Dragons, best pair	1 00
Antwerps, "	1 00
Barbs, best pair black	1 00
Barbs, best pair white	1 00
Barbs, best pair red	1 00
Barbs, best pair yellow	1 00

Cage-Bird Class.

For the best, most varied, and most valuable collection of singing birds, owned and entered by one exhibitor	$5 00
Canaries, best pair (*Belgian song birds*)	2 00
Canaries, best pair (*German*)	2 00

The Minor Pet Class.

Best pair Guinea pigs	Diploma
Best show of white mice	Diploma
Best show of European dormice	Diploma
Best specimen of squirrels	Diploma
Best pair of ferrets	Diploma
Best pair of minks	Diploma

Stuffed Birds.

Best collection	$10 00
Second best collection	5 00

DIVISION E—FARM AND GARDEN PRODUCE AND MANUFACTURED PRODUCTS.

Superintendent—Edwin Phelps, Pontiac.

CLASS 25.—GRAIN AND SEEDS.

Best bushel of winter red wheat, yield not less than 20 bushels to the acre	$10 00
Second best bushel of winter red wheat, yield not less than 20 bushels to the acre	5 00
Best bushel of winter white wheat, yield not less than 20 bushels to the acre	10 00
Second best bushel of winter white wheat, yield not less than 20 bushels to the acre	5 00
Best bushel of spring wheat	5 00
Second best bushel of spring wheat	3 00
Best bushel of rye	3 00
Second best bushel of rye	2 00
Best bushel of four-rowed barley	10 00
Second best bushel of four-rowed barley	5 00
Best bushel of oats	6 00
Second best bushel of oats	4 00
Best bushel of winter barley	6 00
Second best bushel of winter barley	4 00
Best bushel of dent corn, in the ear	6 00
Second best bushel of dent corn, in the ear	4 00
Best bushel of flint corn, in the ear	6 00
Second best bushel of flint corn, in the ear	4 00
Best bushel of other variety of corn	6 00

Second best bushel of other variety of corn	$4 00
Best bushel of peas	6 00
Second best bushel of peas	4 00
Best bushel of white beans	6 00
Second best bushel of white beans	4 00
Best bushel of large clover seed	6 00
Second best bushel of large clover seed	4 00
Best bushel of small clover seed	6 00
Second best bushel of small clover seed	4 00
Best bushel of timothy seed	6 00
Second best bushel of timothy seed	4 00
Best bushel of buckwheat	4 00
Second best bushel of buckwheat	2 00
Best bushel of flax seed	4 00
Best bushel of red-top grass seed	6 00
Second best bushel of red-top grass seed	4 00
Best bushel of blue-grass seed	6 00
Second best bushel of blue-grass seed	4 00
Best sample of hops	4 00
Second best sample of hops	2 00
Bushel of seed of any new variety of valuable grass that has been tried as a crop, of not less than two acres, within the State of Michigan, with a description of the manner of treatment, and how the seed was originally procured by the exhibitor	10 00
Best exhibition of a general assortment of seeds for field crops—greatest variety and quality of seeds to be taken into consideration........Diploma and	20 00
Best assortment and greatest variety of kitchen garden seeds, properly classified........Diploma and	10 00
Best display of a collection of the several kinds of grain in heads, arranged and named........Diploma and	5 00

RULE.—All seeds shown in this class are required to be the growth of the present year.

E—CLASS 26.—ROOTS AND VEGETABLES.

Best and greatest variety of roots for feeding stock	$12 00
Second best and greatest variety of roots for feeding stock	8 00
Third best and greatest variety of roots for feeding stock	4 00
Best and greatest variety of roots and vegetables from any one garden	12 00
Second best and greatest variety of roots and vegetables from any one garden	8 00
Third best and greatest variety of roots and vegetables from any one garden	4 00
Best three varieties of early potatoes, a peck or more of each kind	3 00
Second best three varieties of early potatoes, a peck or more of each kind	2 00
Best three varieties of late potatoes, a peck or more of each kind	3 00
Second best three varieties of late potatoes, a peck or more of each kind	2 00
Best sample of a peck or more early rose	3 00
Second best sample of a peck or more early rose	2 00
Best sample of a peck or more of any other variety of early potatoes	3 00
Second best sample of a peck or more of any other variety of early potatoes	2 00
Best sample of a peck or more white peach-blows	3 00
Second best sample of a peck or more white peach-blows	2 00
Best sample peck or more of any other late variety	3 00
Second best sample peck or more of any other late variety	2 00
Best sample peck or more of sweet potatoes	3 00
Second best sample peck or more of sweet potatoes	2 00
Best dozen or more blood beets	2 00
Second best dozen or more blood beets	1 00
Best dozen or more turnip beets	2 00
Second best dozen or more turnip beets	1 00
Best dozen or more sugar beets	2 00
Second best dozen or more sugar beets	1 00
Best dozen or more white or yellow beets	2 00
Second best dozen or more white or yellow beets	1 00
Best dozen or more beets for table use	2 00
Second best dozen or more beets for table use	1 00
Best collection of five or more kinds of beets, ten of a kind	3 00
Second best collection of five or more kinds of beets, ten of a kind	2 00

Best dozen or more mangel-wurtzel	$2 00
Second best dozen or more mangel-wurtzel	1 00
Best dozen or more orange carrots	2 00
Second best dozen or more orange carrots	1 00
Best dozen or more white carrots	2 00
Second best dozen or more white carrots	1 00
Best dozen or more of any other variety of carrots	2 00
Second best dozen or more of any other variety of carrots	1 00
Best collection of four or more kinds of carrots, at least ten of a kind	3 00
Second best collection of four or more kinds of carrots, at least ten of a kind	2 00
Best dozen or more flat turnips	2 00
Second best dozen or more flat turnips	1 00
Best dozen or more Swede turnips	2 00
Second best dozen or more Swede turnips	1 00
Best dozen or more any other variety of turnips	2 00
Second best dozen or more any other variety of turnips	1 00
Best collection of four or more kinds of turnips, at least ten of a kind	3 00
Second best collection of four or more kinds of turnips, at least ten of a kind	2 00
Best dozen or more parsnips	2 00
Second best dozen or more parsnips	1 00
Best dozen or more salsify	2 00
Second best dozen or more salsify	1 00
Best dozen or more winter radishes	2 00
Second best dozen or more winter radishes	1 00
Best dozen or more summer radishes	2 00
Second best dozen or more summer radishes	1 00
Best collection of three or more kinds of radishes, and at least ten of a kind	3 00
Second best collection of three or more kinds of radishes, and at least ten of a kind	2 00
For best and greatest variety of culinary vegetables, grown by exhibitor	5 00
For second best and greatest variety of culinary vegetables, grown by exhibitor	3 00
Best four heads drumhead cabbage	2 00
Second best four heads drumhead cabbage	1 00
Best four heads cone-head cabbage	2 00
Second best four heads cone-head cabbage	1 00
Best four heads Savoy or curled cabbage	2 00
Second best four heads Savoy or curled cabbage	1 00
Best four heads red cabbage	2 00
Second best four heads red cabbage	1 00
Best collection of five or more kinds of cabbage, four or more heads of each kind	3 00
Second best collection of five or more kinds of cabbage, four or more heads of each kind	2 00
Best four heads cauliflower	2 00
Second best four heads cauliflower	1 00
Best four heads broccoli	2 00
Second best four heads broccoli	1 00
Best six heads lettuce	2 00
Second best six heads lettuce	1 00
Best six bunches kale	2 00
Second best six bunches kale	1 00
Best dozen stems celery, bleached	2 00
Second best dozen stems celery, bleached	1 00
Best dozen stems rhubarb	2 00
Second best dozen stems rhubarb	1 00
Best half-dozen vegetable eggs	2 00
Second best half-dozen vegetable eggs	1 00
Best dozen peppers	2 00
Second best dozen peppers	1 00
Best three varieties of tomatoes, one dozen each	3 00
Second best three varieties of tomatoes, one dozen each	2 00
Best peck any variety of tomatoes	3 00
Second best peck any variety of tomatoes	2 00
Best peck white onions	3 00
Second best peck white onions	2 00

55

Best peck red onions	$3 00
Second best peck red onions	2 00
Best peck yellow onions	3 00
Second best peck yellow onions	2 00
Best collection of five or more kinds of onions, not less than one-half peck of a kind	3 00
Second best collection of five or more kinds of onions, not less than one-half peck of a kind	2 00
Best five summer squashes	2 00
Second best five summer squashes	1 00
Best five marrow squashes	2 00
Second best five marrow squashes	1 00
Best five Hubbard squashes	2 00
Second best five Hubbard squashes	1 00
Best single squash	2 00
Second best single squash	1 00
Best collection of four or more kinds of squashes, at least three of a kind	3 00
Second best collection of four or more kinds of squashes, at least three of a kind	2 00
Best two sweet pumpkins	2 00
Second best two sweet pumpkins	1 00
Best two field pumpkins	2 00
Second best two field pumpkins	1 00
Best three watermelons	2 00
Second best three watermelons	1 00
Best three muskmelons	2 00
Second best three muskmelons	1 00
Best three nutmeg melons	2 00
Second best three nutmeg melons	1 00
Best three citrons	2 00
Second best three citrons	1 00
Best collection of three or more kinds of melons, and three or more of each kind	3 00
Second best collection of three or more kinds of melons, and three or more of each kind	2 00
Best five cucumbers	2 00
Second best five cucumbers	1 00
Best half peck garden peas	2 00
Second best half peck garden peas	1 00
Best half peck lima beans	2 00
Second best half peck lima beans	1 00
Best peck bush beans	2 00
Second best peck bush beans	1 00
Best half peck wax beans	2 00
Second best half peck wax beans	1 00
Best collection of three or more kinds of garden beans, one-half peck or more of a kind	3 00
Second best collection of three or more kinds of garden beans, one-half peck or more of a kind	2 00
Best dozen ears early sweet corn	2 00
Second best dozen ears early sweet corn	1 00
Best dozen ears late sweet corn	2 00
Second best dozen ears late sweet corn	1 00
Best dozen ears pop corn	2 00
Second best dozen ears pop corn	1 00
Best six heads sunflower	2 00
Second best six heads sunflower	1 00
Best six stems Swiss chard	2 00
Second best six stems Swiss chard	1 00
Best six stems parsley	2 00
Second best six stems parsley	1 00
Best six stems spinach	2 00
Second best six stems spinach	1 00
Best six stems any sweet or pot herb	2 00
Second best six stems any sweet or pot herb	1 00
Best collection of four or more kinds sweet or pot herb	3 00
Second best collection of four or more kinds sweet or pot herb	2 00

Best six stems kohl rabi	$2 00
Second best six stems kohl rabi	1 00

E—CLASS 27.—FLOUR, MEAL, AND FEED.

Best barrel flour made of white wheat	$5 00
Second best barrel flour made of white wheat	3 00
Best barrel flour made of red wheat	5 00
Second best barrel flour made of red wheat	3 00
Best barrel flour made of spring wheat	3 00
Second best barrel flour made of spring wheat	2 00
Best sample bolted meal	2 00
Second best sample bolted meal	1 00
Best sample corn meal	2 00
Second best sample corn meal	1 00
Best sample ground feed	2 00
Second best sample ground feed	1 00
Best sample buckwheat flour	2 00
Second best sample buckwheat flour	1 00
Best sample rye flour	2 00
Second best sample rye flour	1 00
Best sample graham flour	2 00
Second best sample graham flour	1 00
Best sample oat meal	2 00
Second best sample oat meal	1 00
Best and largest display of flour, meal and feed	5 00
Second best and largest display of flour, meal and feed	3 00

E—CLASS 28.—BUTTER AND CHEESE.

Best twenty-five pounds of domestic butter, made at any time	$25 00
Second best twenty-five pounds of domestic butter, made at any time	20 00
Third best twenty-five pounds of domestic butter, made at any time	15 00
Best display of cheese, not less than three in number, from any household or private dairy	15 00
Second best display of cheese, not less than three in number, from any household or private dairy	10 00
Third best display of cheese, not less than three in number, from any household or private dairy	5 00
Best display of cheese by any factory, quality considered.....Silver medal and	35 00
Second best display of cheese by any factory, quality considered	25 00
Third best display of cheese by any factory, quality considered	15 00

E—CLASS 29.—SUGAR, HONEY, AND BEE-HIVES.

Best gallon maple syrup	$3 00
Second best gallon maple syrup	2 00
Best ten pounds of maple sugar	5 00
Second best ten pounds of maple sugar	3 00
Best specimen of honey, in boxes or jars	3 00
Second best specimen of honey, in boxes or jars	2 00
Best bee-hives, and method of securing honey and taking care of bees, Diploma and	5 00
Best display of samples of commercial sugars and syrups, named and labeled	5 00
Second best display of samples of commercial sugars and syrups, named and labeled	3 00

E—CLASS 30.—BREAD AND PICKLES.

Best machine-made bread	Diploma
Best three loaves of baker's bread	Diploma
Best three loaves of milk or salt-rising bread	$3 00
Second best three loaves of milk or salt-rising bread	2 00
Best three loaves of yeast bread	3 00
Second best three loaves of yeast bread	2 00
Best soda-rising bread	3 00
Second best soda-rising bread	2 00
Best corn bread	3 00
Second best corn bread	2 00
Best three loaves of brown bread, or rye and Indian	3 00

Second best three loaves of brown bread, or rye and Indian		$2 00
Best sample of flour bread, made by a girl of sixteen years or under		3 00
Second best sample of flour bread, made by a girl of sixteen years or under		2 00
Best sample of brown bread, by a girl sixteen years or under		3 00
Second best sample of brown bread, by a girl of sixteen years or under		2 00
Best display of varieties of crackers, made by any one person	Diploma	
Best display of specimens of pickled vegetables, including cucumbers, onions, cabbage, tomatoes, and beans		$5 00
Second best display of specimens of pickled vegetables, including cucumbers, onions, cabbage, tomatoes, and beans		3 00

The executive committee esteem it of the utmost importance to encourage the arts which promote comfort and economy to the household. There will probably be many articles entered under this class which are not enumerated. Such articles as may be deemed meritorious the committee are instructed to act upon, and to make such awards as may seem just.

E—CLASS 31.—SOAPS, TOILET ARTICLES, SAMPLES OF PREPARED GROCERIES, ETC.

Best display of fine groceries	Diploma
Best display of toilet articles, including hair dyes, tooth powders and washes, hair oils, pomatum and cosmetics	Diploma
Best display of toilet soaps	Diploma
Best display of washing soaps	Diploma
Best prepared pop corn	Diploma
Best display of confectionery	Diploma
Best display of flavoring extracts	Diploma
Best display of ground spices	Diploma

E—CLASS 32.—MISCELLANEOUS.

All articles pertaining to Division E, not heretofore enumerated, shall be placed in this class. Committee to be appointed on the ground.

DIVISION F.—FARM IMPLEMENTS AND THEIR TRIALS.

Superintendents—E. O. Hanford, Plymouth, Wayne, Abel Angel, Bradley, Allegan, A trial of implements and machinery in this division will not be required.

F—CLASS 33.—PLOWS.

Best plow for turning sod land or green sward	Diploma and	$5 00
Best plow for turning under stubble		5 00
Best plow for general use made in Michigan	Diploma and	10 00
Best plow for general use made in any other State	Diploma and	5 00
Best heavy plow for new land	Diploma and	5 00
Best attachment for any plow for covering grass or long manure		5 00
Best subsoil plow	Diploma and	5 00
Best draining or ditching plow	Diploma and	5 00
Best self-cleaning plow coulter	Diploma	
Best attachment for any plow for subsoiling	Diploma	
Best gang plow	Diploma	
Best dynamometer	Diploma	
Largest and best display of plows to be exhibited by manufacturers		$75 00
Second largest and best display of plows to be exhibited by manufacturers		50 00
Third largest and best display of plows to be exhibited by manufacturers		25 00

F—CLASS 34.—TILLAGE IMPLEMENTS.

Best field roller	Diploma and	$5 00
Best harrow, for general use	Diploma and	5 00
Best iron harrow	Diploma and	3 00
Best wooden harrow	Diploma and	3 00
Best one-horse cultivator	Diploma	
Best machine for hoeing and weeding drills in garden	Diploma	
Best display of cultivators exhibited by manufacturers		$75 00
Second best display of cultivators exhibited by manufacturers		50 00
Third best display of cultivators exhibited by manufacturers		25 00

F—CLASS 35.—SEED DRILLS, SOWERS, PLANTERS, ETC.

Best two-horse seed drill	$40 00
Second best two-horse seed drill	25 00
Best two-horse seeder for grain	30 00
Second best two-horse seeder for grain	20 00
Best grass and clover seed sower for horse power	Diploma
Best ashes and plaster sower attached to horse power	Diploma
Best grass seed sower for hand work	Diploma
Best ashes and plaster sower for hand work	Diploma
Best corn and bean planter to work with horse power	Diploma
Best drill machine for sowing turnips, carrots, or beets, by horse power	Diploma
Best drill for sowing seeds of root crops by hand	Diploma
Best machine for sowing plaster, ashes, or artificial manure	Diploma
Best hand corn-planter	Diploma

F—CLASS 36.—HAYING AND HARVESTING IMPLEMENTS.

Best horse-rake	$20 00
Second best horse-rake	15 00
Third best horse-rake	10 00
Best machine for mowing lawns by hand	Diploma
Best loading apparatus	Diploma
Best horse pitchfork	Silver medal
Second best horse pitchfork	Diploma
Best corn-cutter, horse-power	Diploma
Best contrivance for husking corn	Diploma
Best clover seed gatherer	Medal
Best hay rigging, for double wagon	Diploma
Best hay rigging, for an ox or horse cart	Diploma
Best potato-digger	Diploma
For any machine that will dig potatoes by horse-power, a method satisfactory to the committee	Silver medal
Best hay press	Silver medal

NOTE.—By resolution of the executive committee, at its annual meeting, all premiums on mowers and reapers were ordered stricken out of the premium list; but all parties desiring to exhibit their machines are to have every facility offered them. It was deemed only just, that as no fair trial could be made at the season of the fair, no award should be made giving one machine a preference over another.

F—CLASS 37.—APPARATUS AND MACHINES CONNECTED WITH THE CLEANING AND PREPARATION OF CROPS FOR MARKET AND FOR THE FEEDING OF STOCK.

Best horse-power for general use	$30 00
Second best horse-power for general use	15 00
Greatest and best display of feed-cutters	25 00
Second greatest and best display of feed-cutters	15 00
Greatest and best display of corn-shellers	15 00
Second greatest and best display of corn-shellers	10 00
Best fanning mill or grain-cleaner	Diploma
Best straw and stalk-cutter for hand power	Diploma
Best root-cutter	Diploma
Best machine for pulping roots, that they may be mixed with cut straw, hay, or chaff	Diploma
Best, simplest, and most substantial contrivance for steaming food for cattle and hogs, not less than twenty head of each	Medal
Best contrived feeding rack for sheep	Diploma
Best plan for feeding swine	Diploma
Best plan for feeding calves	Diploma
Best portable cider mill	Diploma
Best portable steam engine, to be used for agricultural purposes	Diploma and medal
Best portable grist mill	Medal
Best apparatus for evaporating maple syrup	Medal
Best hop press	Medal
Best hay or cattle scales, to be placed near the forage and cattle	Medal

F—CLASS 38.—MISCELLANEOUS FARM ARTICLES.

All miscellaneous farm articles pertaining to this division to be enumerated under this class, and the committee will make such recommendations as they may deem proper.

Best drag sawing-machine	$20 00
Rest circle sawing-machine	20 00
Best stump-puller, capable of lifting ten tons	20 00
Best grubbing machine	Diploma
Best one-half dozen spading forks	$2 00
Best one-half dozen four-tine manure forks	2 00
Best one-half dozen six-tine manure forks	2 00
Best one-half dozen three-tine straw forks	2 00
Best one-half dozen four-tine straw forks	2 00
Best one-half dozen two-tine straw forks	2 00
Best one-half dozen socket hoes	2 00
Best one-half dozen shank hoes	2 00
Best one-half dozen steel-tooth garden-rakes	2 00
Best one-half dozen potato hooks	2 00
Best assortment of garden tools	Diploma
Best set of draining or ditching tools	Diploma
Best set of grafting tools	Diploma
Best road-scraper	$2 00
Best pump and power combined	Diploma
Best windmill and pump	Medal
Best three-horse clevis	Diploma
Best wheel barrow	Diploma
Best six hand corn-cutters	Diploma
Best six grub-hoes	Diploma
Best hand machine for sawing wood	Diploma
Best grain cradle	Diploma
Best six shovels	$2 00
Best six spades	2 00
Best six axes	2 00
Best set of grain measures	2 00
Best ox yoke	2 00
Best six bush hooks	2 00
Best grindstone with best hangings	Diploma
Best fruit ladders	Diploma
Best fruit-gatherers	Diploma
Best hand pump for wells	Diploma
Best water-lifter for wells	Diploma
Best cistern pump	Diploma
Best farm gate	Diploma
Best farm fence	Diploma

F—CLASS 39.—DAIRY AND HOUSEHOLD ARTICLES.

Best churn for making butter, either rotary or other movement	Diploma
Best cheese press	Diploma
Best milk pans, not less than six	Diploma
Best cheese vat, for cheese making	Diploma
Best milk strainer	Diploma
Best milk safe	Diploma
Best dozen brooms	Diploma
Best six mops and handles	Diploma
Best weights and scales for dairy use	Diploma
Best washing-machine	Diploma
Best clothes-wringing machine	Diploma
Best clothes horse	Diploma
Best assortment of wooden ware for dairy or kitchen use	Diploma
Best assortment of tin or metal ware for dairy or kitchen use	Diploma
Best hand loom	Diploma
Best fruit-drier	Diploma
Best coffee-burner	Diploma
Best clothes-sprinkler	Diploma
Best water filter and cooler	Diploma

Best fruit boxes for grapes and other small fruit	Diploma
Best metal cans for preserving fruit	Diploma
Best glass cans for preserving fruit	Diploma
Best specimens of dish covers	Diploma
Best cheese safe	Diploma
Best corn-popper	Diploma
Best egg-beater	Diploma
Best refrigerator	Diploma
Best clothes-drier	Diploma
Best clothes mangler	Diploma
Best half dozen wooden pails	Diploma
Best half dozen wash-tubs	Diploma
Best machine for working butter	Diploma

DIVISION G—VEHICLES.

Superintendent—G. W. Griggs, Grand Rapids.

G—CLASS 40.—WAGONS AND CARRIAGES.

Best two-horse family carriage	Diploma and	$10 00
Second best two-horse family carriage		5 00
Best one-horse carriage	Diploma and	5 00
Second best one-horse carriage		5 00
Best two-spring phaeton	Diploma and	5 00
Second best two-spring phaeton		5 00
Best three-spring phaeton	Diploma and	5 00
Second best three-spring phaeton		5 00
Best top buggy	Diploma and	5 00
Second best top buggy		5 00
Best buggy without top	Diploma and	5 00
Second best buggy without top		5 00
Best trotting wagon	Diploma and	5 00
Second best trotting wagon		5 00
Best trotting sulky	Diploma and	5 00
Second best trotting sulky		5 00
Best farm wagon for all purposes		10 00
Second best farm wagon for all purposes		5 00
Best spring wagon for market		10 00
Second best spring wagon for market		5 00
Best omnibus		10 00
Second best omnibus		5 00
Best two-horse family sleigh		10 00
Second best two-horse family sleigh		5 00
Best single sleigh or cutter		5 00
Second best single sleigh or cutter		3 00
Best single farm wagon		5 00
Second best single farm wagon		3 00
Best horse cart		5 00
Second best horse cart		3 00
Best ox cart		5 00
Second best ox cart		3 00
Best dray		5 00
Second best dray		3 00
Pair of bob sleighs for lumbering		Diploma
Trucks for lumbering purposes		Diploma
Carriage jack		Diploma

DIVISION H—MACHINERY.

Superintendents—Wm. M. Ferry, Grand Haven; Charles Kipp, St. Johns.

H—CLASS 41.—MACHINERY FOR WORKING UPON IRON AND OTHER METALS.

Steam engine to be shown in operation	Medal
Iron planer	Diploma
Iron lathe	Diploma
Iron shaping machine	Diploma
Iron boring machine	Diploma

Iron drilling machine	Diploma
Machine for cutting threads on bolts and nuts	Diploma
Steam pump	Diploma
Steam fan-blower	Diploma
Portable forge	Medal
Shafting	Medal
Hangers and pulleys	Medal
Self-oiler for machines	Medal
Steam gauge	Medal
Governor for engine	Diploma
Low water detector	Medal
Machine for making metallic pipe	Diploma
Coupling for shafting	Medal
Steam valves	Medal
Flue scraper and cleaner	Medal

Machinery for working upon wood.

Sawmill	Medal
Circular saw	Medal
Upright saw	Medal
Saw gummer	Medal
Cross-cut saw	Medal
Lath sawing-machine	Medal
Machine for edging lumber	Diploma
Machine for making shingles	Diploma
Machine for fastening belts together	Medal
Scroll saw	Medal
Belting	Diploma
Planer and matcher	Medal
Dovetailing machine	Diploma
Tenoning machine	Diploma
Mortising machine	Diploma
Heading machine	Diploma
Stave-cutting machine	Medal
Clothes-pin machine	Diploma
Sawmill head blocks	Diploma
Surface-planer	Medal
Spoke-dressing machine	Diploma
Moulding machine	Diploma
Stave-jointer	Medal
Heading-jointer	Medal
Saw arbor	Medal
Railroad cut-off saw	Diploma
Blind wiring machine	Medal
Broom-handle lathe	Diploma
Automatic lathe	Diploma
Foot-power lathe	Diploma

Miscellaneous machinery.

Machine for making brick	Diploma
Steam printing-press	Medal
Card printing-press	Medal
Press brick machine	Medal
Steam tile machine	Diploma
Machine for making rope and cordage	Diploma
Turbine water wheel	Diploma
Grocer's coffee-mill	Diploma
Machine for ruling paper	Diploma
Paint mill	Diploma
Steam fire engine	Diploma
Hand fire engine	Diploma
Garden engine	Medal
Emery wheel	Medal

All models of whatever kind must be entered in this class, and the Viewing Committee will examine them, report on them, and, if considered worthy, a diploma or certificate of the Society will be awarded by such committee.

All utensils and articles of machinery not elsewhere classified, may be entered in this class, and will be reported on by the Viewing Committee, who are empowered to recommend such premiums as they may deem just.

H—CLASS 42.—RAILROAD ROLLING STOCK.

Committee to be filled by the President on the ground.

Passenger engine	Silver medal
Freight engine	Silver medal
Passenger car for service	Diploma
Car for transportation of live stock	Diploma
Combination freight car	Diploma
Sleeping car for passengers	Diploma
Drovers' car	Diploma

DIVISION I.—DEPARTMENT OF MANUFACTURED GOODS.

Superintendents—N. L. Avery, Grand Rapids, Kent; J. Q. A. Burrington, Worth, Tuscola.

The Viewing Committee shall examine all entries belonging to their respective classes not enumerated in the premium list, and may recommend the award of discretionary premiums to articles of superior merit.

I—CLASS 43.—HOME-MADE.

Best pair of woolen blankets	$5 00
Second best pair of woolen blankets	3 00
Best ten yards of woolen cloth	4 00
Second best ten yards of woolen cloth	2 00
Best ten yards of woolen flannel	4 00
Second best ten yards of woolen flannel	2 00
Best ten yards of woolen carpet	4 00
Second best ten yards of woolen carpet	2 00
Best hearth rug	3 00
Second best hearth rug	2 00
Best ten yards of rag carpet	3 00
Second best ten yards of rag carpet	2 00
Best woolen coverlet	3 00
Second best woolen coverlet	2 00
Best ten yards of satinet	3 00
Second best ten yards of satinet	2 00
Best woolen shawl	3 00
Second best woolen shawl	2 00
Best pair of woolen stockings	2 00
Second best pair of woolen stockings	1 00
Best pair of woolen mittens	2 00
Second best pair of woolen mittens	1 00
Best pair of woolen gloves	2 00
Second best pair of woolen gloves	1 00
Best two pounds stocking yarn	3 00
Second best two pounds stocking yarn	2 00
Best pair cotton socks	2 00
Second best pair cotton socks	1 00
Best woolen scarf	2 00
Second best woolen scarf	1 00
Best knitted bed-spread	4 00
Second best knitted bed-spread	2 00
Best white table-cloth	2 00
Second best white table cloth	1 00
Best pair of woolen shirts	2 00
Second best pair of woolen shirts	1 00
Best white bed-spread	5 00
Second best white bed-spread	3 00
Best patchwork quilt	3 00
Second best patchwork quilt	2 00
Best ten yards of diaper	3 00
Second best ten yards of diaper	2 00

Best ten yards of tow cloth	$3 00
Second best ten yards of tow cloth	2 00
Best and greatest variety of articles manufactured by any one family, but not containing any article entered separately for single premiums, or that has been exhibited at any previous State Fair	15 00

I—CLASS 44.—FACTORY-MADE.

Best display of goods from any woolen factory in Michigan	$25 00
Second best display of goods from any woolen factory in Michigan	20 00
Third best display of goods from any woolen factory in Michigan	10 00
Best piece of fancy cassimere, weighing twelve ounces or over per yard, Diploma and	5 00
Second best piece of fancy cassimere, weighing twelve ounces or over per yard	3 00
Best piece of plain cassimere, weighing twelve ounces or over per yard, Diploma and	5 00
Second best piece of plain cassimere, weighing twelve ounces or over per yard	3 00
Best and largest display of flannels made by any one factory in Michigan	Medal
Best piece of overcoat cloth, weighing twelve ounces or over per yard, Diploma and	$5 00
Best piece of broadcloth manufactured in Michigan. Medal and	5 00
Best display of cotton or silk goods, manufactured in or out of the State, Medal and	5 00
Best display of cotton goods, manufactured in Michigan. Medal and	10 00
Best and handsomest display of carpets	Diploma
Best twenty-five yards of wool carpet, manufactured in Michigan	$5 00
Best and handsomest five hearth rugs	Diploma
Best and handsomest five fancy door-mats	Diploma
Best display of window curtains	Diploma
Best and finest display of window blinds	Diploma
Best display of oil-cloths	Diploma
Best white woolen blankets	Diploma
Best two Marseilles quilts	Diploma
Best woolen manufactured coverlet, not previously shown. Diploma and	$3 00
Second best woolen manufactured coverlet, not previously shown	2 00
Best display of paper hangings	Diploma
Best display of cotton batting	Diploma

I—CLASS 45.—ARTICLES OF DRESS.

Best suit of men's clothes, including coat, vest, and pantaloons. Diploma and	$5 00
Best made overcoat	3 00
Best made dress coat	3 00
Best made frock coat	3 00
Best three undershirts and drawers of flannel	1 00
Best three undershirts and drawers of cotton	1 00
Best three undershirts and drawers of silk	1 00
Best made shirts, five in number	3 00
Best display silk hats	Diploma
Best display fur hats	Diploma
Best display soft hats	Diploma
Best display straw hats	$1 00
Best display boys' caps	1 00
Best display gents' furs	1 00

I—CLASS 46.—ARTICLES OF LEATHER AND INDIA RUBBER.

Best traveling trunk	$5 00
Second best traveling trunk	3 00
Best carpet bag	1 00
Best lady's sachel	1 00
Best pair of gents' summer boots	2 00
Best pair of gents' winter boots	2 00
Best pair kip boots	1 00
Best pair of lady's summer walking boots	1 00
Best pair lady's winter walking boots	1 00
Best pair of lady's winter shoes	1 00
Best pair of gents' slippers	1 00
Best pair of lady's slippers	1 00

Best double carriage harness	Diploma and	$5 00
Second best double carriage harness		5 00
Best single or buggy harness	Diploma and	3 00
Best double harness for farm	Diploma and	3 00
Second best double harness for farm		3 00
Best single harness for farm		2 00
Best cart harness		2 00
Best sole leather		1 00
Best calf skin		1 00
Best other kinds of leather		2 00
Best morocco leather		1 00
Best gent's riding saddle		2 00
Best lady's riding saddle		2 00
Best horse collar		1 00
Best leather belting		Diploma
Best rubber belting		Diploma
Best display of boots and shoes of all kinds		Medal
Best display of traveling bags		Diploma
Best fancy buffalo robe		2 00
Best fancy blanket		2 00
Best enameled leather		1 00
Best assortment of India rubber goods	Diploma and	3 00

I—CLASS 47.—ARTICLES OF FURNITURE.

Best set parlor furniture, not less than seven pieces	Diploma and	$10 00
Second best set parlor furniture, not less than seven pieces		8 00
Best sofa		5 00
Second best sofa		3 00
Best lounge or couch		5 00
Second best lounge or couch		3 00
Best easy chair		3 00
Second best easy chair		2 00
Best smoking or lounging chair		3 00
Second best smoking or lounging chair		2 00
Best upholstered reception chair		5 00
Second best upholstered reception chair		3 00
Best center table		5 00
Second best center table		3 00
Best library table		5 00
Second best library table		3 00
Best pier mirrors and base		5 00
Second best pier mirrors and base		3 00
Best mantel mirror		5 00
Second best mantel mirror		3 00
Best window cornice		3 00
Second best window cornice		2 00
Best lamberquin		3 00
Second best lamberquin		2 00
Best set chamber furniture, not less than three pieces	Diploma and	10 00
Second best set chamber furniture, not less than three pieces		8 00
Best spring mattress		3 00
Second best spring mattress		2 00
Best mattress for bed		3 00
Second best mattress for bed		2 00
Best dressing bureau		5 00
Second best dressing bureau		3 00
Best set dining room chairs		3 00
Second best set dining-room chairs		2 00
Best extension table		5 00
Second best extension table		3 00
Best sideboard		5 00
Second best sideboard		3 00
Best book-case		5 00
Second best book-case		3 00
Best secretary		5 00
Second best secretary		3 00

Best parlor writing desk	$5 00
Second best parlor writing desk	3 00
Best office desk	5 00
Second best office desk	3 00
Best office chair	3 00
Second best office chair	2 00
Best desk of any kind	5 00
Second best desk of any kind	3 00
Best hall tree or hat rack	5 00
Second best hall tree or hat rack	3 00
Display of furniture of all kinds	Diploma and 10 00
Set willow or rattan furniture	Diploma
Best child's crib	3 00
Second best child's crib	2 00
Best child's carriage	3 00
Second best child's carriage	2 00
Display of children's willow or rattan chairs	Diploma
Display of veneers	Diploma
Best display of rustic wood-work	5 00
Second best display of rustic wood-work	3 00
Specimen of carved work in wood	Diploma
School seat and desk	Diploma
Assortment of school furniture	Medal
Billiard table	Medal and Diploma

I—CLASS 48.—STOVES, IRON WORK, AND ORNAMENTAL CONCRETE WORK.

Best display of stoves	Silver Medal
Best cooking stove for wood fire	Medal
Best cooking stove for coal fire	Medal
Best parlor or hall stove	$5 00
Best self-regulating stove for parlor	5 00
Best office or depot stove	5 00
Best assortment of hollow ware	Diploma
Best apparatus for cooking range	Diploma
Best furnace or other apparatus for warming houses,—economy of construction, consumption of fuel, security to premises, and facility of ventilation to be taken into consideration	Silver medal
Base-burning coal stove	Diploma

Exhibitors of stoves will be at liberty to show the capacity of the articles entered by actual trial on the ground, if they prefer to do so.

Best ornamental cast-iron vase on pedestal	$3 00
Best cast-iron gate	3 00
Best cast-iron fence	3 00
Best ornamental fountain	2 00
Best parlor grate	2 00
Best casting for fire front	2 00
Best ornamental statuary	2 00
Best iron chair	1 00
Best fruit and flower stand	1 00
Best display of rustic work	2 00
Best galvanized iron cornice	3 00
Best window and door sills of concrete or terra cotta work	Diploma
Best horticultural ornamented concrete or terra cotta work	Diploma
Best ornamental vases, concrete or terra cotta work	Diploma
Best display of concrete or terra cotta work	Medal

DIVISION J—MUSICAL INSTRUMENTS AND SEWING-MACHINES.

Superintendent—C. L. Whitney, Muskegon.

CLASS 49.

A fine building is provided for the exhibition of these goods, but no awards will be made.

DIVISION K—PAINTING, NEEDLE-WORK, ETC.

CLASS 49.—PAINTING AND SCULPTURE.

Superintendents—J. W. Childs, Ypsilanti, Washtenaw; J. G. Ramsdell, Traverse City.

Articles in this Class will be numbered and catalogued for the assistance of visitors.

Best historical painting in oil, done by exhibitor	$8 00
Second best historical painting in oil, done by exhibitor	5 00
Best composition landscape in oil, done by exhibitor	8 00
Second best composition landscape in oil, done by exhibitor	5 00
Best landscape from nature, in oil, done by exhibitor	5 00
Second best landscape from nature, in oil, done by exhibitor	3 00
Best marine scene, in oil, done by exhibitor	5 00
Second best marine scene, in oil, done by exhibitor	3 00
Best animal piece, from life, in oil, done by exhibitor	5 00
Second best animal piece, from life, in oil, done by exhibitor	3 00
Best bird piece, in oil, done by exhibitor	3 00
Second best bird piece, in oil, done by exhibitor	2 00
Best fruit piece, in oil, done by exhibitor	3 00
Second best fruit piece, in oil, done by exhibitor	2 00
Best portrait, from life, large size, in oil, done by exhibitor	5 00
Second best portrait, from life, large size, in oil, done by exhibitor	3 00
Best portrait, from life, cabinet size, in oil, done by exhibitor	3 00
Second best portrait, from life, cabinet size, in oil, done by exhibitor	2 00
Best fancy painting, in oil, done by exhibitor	3 00
Second best fancy painting, in oil, done by exhibitor	2 00
Best head, cabinet size, in oil, done by exhibitor	3 00
Second best head, cabinet size, in oil, done by exhibitor	2 00
Best oil painting by person under 16, done by exhibitor	3 00
Second best oil painting by person under 16, done by exhibitor	2 00
Best landscape painting, in water colors, done by exhibitor	3 00
Second best landscape painting, in water colors, done by exhibitor	2 00
Best portrait painting, in water colors, done by exhibitor	3 00
Second best portrait painting, in water colors, done by exhibitor	2 00
Best animal painting, in water colors, done by exhibitor	3 00
Second best animal painting, in water colors, done by exhibitor	2 00
Best fancy painting, in water colors, done by exhibitor	3 00
Second best fancy painting, in water colors, done by exhibitor	2 00
Best historical painting, shown by any person	5 00
Second best historical painting, shown by any person	3 00
Best landscape painting, shown by any person	3 00
Second best landscape painting, shown by any person	2 00
Best marine painting, shown by any person	3 00
Second best marine painting, shown by any person	2 00
Best portrait in oil, shown by any person	3 00
Second best portrait, in oil, shown by any person	2 00
Best other paintings in oil, shown by any person	3 00
Second best other paintings in oil, shown by any person	2 00
Best water-color painting, shown by any person	3 00
Second best water-color painting, shown by any person	2 00
Best collection of oil paintings, not less than five in number, by a person not a dealer	8 00
Second best collection of oil paintings, not less than five in number, by a person not a dealer	5 00
Best collection of water-color paintings, not less than five in number, by a person not a dealer	5 00
Second best collection of water-color paintings. not less than five in number, by a person not a dealer	3 00
Best collection of oil paintings by any dealer or association	10 00
Second best collection of oil paintings by any dealer or association	5 00
Best collection of water-color paintings by any dealer or association	5 00
Second best collection of water-color paintings by any dealer or association	3 00
Best statue in marble	5 00
Second best statue in marble	3 00
Best statue in clay, plaster, or terra cotta	3 00
Second best statue in clay, plaster, or terra cotta	2 00

Best statuette in clay, plaster, or terra cotta	$3 00
Second best statuette in clay, plaster, or terra cotta	2 00
Best statuette in marble	3 00
Second best statuette in marble	2 00
Best bust in marble	3 00
Second best bust in marble	2 00
Best bust in clay, plaster, or bronze	3 00
Second best bust in clay, plaster, or bronze	2 00
Best relievo in marble, clay, plaster, or wax	3 00
Second best relievo in marble, clay, plaster, or wax	2 00
Best collection of statuary	10 00
Best pastel painting of face	3 00
Second best pastel painting of face	2 00
Best pastel painting of animal	3 00
Second best pastel painting of animal	2 00
Best pastel painting of landscape	3 00
Second best pastel painting of landscape	2 00
Best crayon drawing of face	3 00
Second best crayon drawing of face	2 00
Best crayon drawing of animal	3 00
Second best crayon drawing of animal	2 00
Best crayon drawing of landscape	3 00
Second best crayon drawing of landscape	2 00
Best collection of photographs by any person .... Diploma and	3 00
Best portrait photograph, life size	3 00
Second best portrait photograph, life size	2 00
Best landscape photograph	3 00
Second best landscape photograph	2 00
Best animal photograph	3 00
Second best animal photograph	2 00
Best portrait photograph, colored	3 00
Second best portrait photograph, colored	2 00
Best three cabinet photographs	3 00
Second best three cabinet photographs	2 00
Best one-half dozen miniature photographs	3 00
Second best one-half dozen miniature photographs	2 00
Best collection of chromo lithographs, not less than five in number	5 00
Second best collection of chromo lithographs, not less than five in number	3 00
Best single chromo lithograph	3 00
Second best single chromo lithograph	2 00
Best collection of plain lithographs, not less than five in number	3 00
Second best collection of plain lithographs, not less than five in number	2 00
Best single plain lithograph	3 00
Second best single plain lithograph	2 00
Best engraving, steel plate	5 00
Second best engraving, steel plate	8 00
Best engraving, wood cut	3 00
Second best engraving, wood cut	2 00
Best pencil drawing, full animal	3 00
Second best pencil drawing, full animal	2 00
Best pencil drawing, landscape	3 00
Second best pencil drawing, landscape	2 00
Best pencil drawing by a person under 14 years	3 00
Second best pencil drawing by a person under 14 years	2 00
Best drawing of any animal upon the grounds	5 00
Second best drawing of any animal upon the grounds	3 00
Best drawing of any building upon the grounds	5 00
Second best drawing of any building upon the grounds	3 00
Best India-ink drawing	3 00
Second best India-ink drawing	2 00
Best map drawing	3 00
Second best map drawing	2 00
Best specimen architectural drawing	3 00
Second best specimen architectural drawing	2 00
Best specimen machinery drawing	3 00
Second best specimen machinery drawing	2 00

Best specimen naval drawing	$3 00
Second best specimen naval drawing	2 00
Best specimen crayon drawing	3 00
Second best specimen crayon drawing	2 00
Best practical penmanship, by gentleman	2 00
Second best practical penmanship, by gentleman	1 00
Best practical penmanship, by lady	2 00
Second best practical penmanship, by lady	1 00
Display of ornamental penmanship	Diploma
Display of pen drawing	Diploma
Best specimen of penmanship by boy or girl, under 15 years of age	$5 00
Second best specimen of penmanship by boy or girl, under 15 years of age	2 00
Best sample etching on glass	3 00
Second best sample etching on glass	2 00
Best sample gilding on glass	3 00
Second best sample gilding on glass	2 00
Best sign painting	3 00
Second best sign painting	2 00
Best window-shade painting	3 00
Second best window-shade painting	2 00
Best flag and banner painting	3 00
Second best flag and banner painting	2 00
Collection imitations of wood and marble	Diploma
Display of gilt frames	Diploma
Display of artists' materials	Diploma
Collection of chromos not less than ten in number	Diploma and $5 00
Best single chromo	3 00
Second best single chromo	2 00
Best chromo landscape	2 00
Second best chromo landscape	1 00
Best chromo portrait	2 00
Second best chromo portrait	1 00
Best chromo of animals or birds	2 00
Second best chromo of animals or birds	1 00
Illustration of chromo painting	Diploma and 5 00
Best set stereoscopic views	3 00
Second best set stereoscopic views	2 00
Plan for city and suburban residence, with specifications and cost	Diploma
Plan for farm house, with specifications and cost	Diploma
Plan for farm barn, with specifications and cost	Diploma
Plan for union and ward school-house, etc., with specifications and cost	Diploma
Plan for district and ward school-house, with specifications and cost	Diploma
Plan for poultry house for 50 or more fowls, with specifications and cost	Diploma
Plan for other farm buildings, with specifications and cost	Diploma
Plan for county agricultural society grounds	Diploma

N. B.—Commercial Colleges will not be allowed to compete for the penmanship premiums, nor will premiums be awarded to such colleges, but ample room for display will be given them.

I—CLASS 50.—PHILOSOPHICAL, SURGICAL, AND OTHER INSTRUMENTS AND APPARATUS.

Display of optical instruments	Diploma
Display of school apparatus	Diploma
Set surveyor's instruments	Diploma
Set mathematical instruments	Diploma
Set drawing instruments	Diploma
Set dental instruments	Diploma
Set surgical instruments	Diploma
Electric telegraph apparatus	Diploma
Magnectic apparatus	Diploma
Galvanic apparatus	Diploma
Meteorological apparatus	Diploma
Set hydrometers and saccharometers	Diploma
Artificial teeth	Diploma
Artificial leg or arm	Diploma
Display set of artificial teeth on gold	Diploma

Display set of artificial teeth on rubber	Diploma
Display of dental work	Diploma
Display spectacles	Diploma
Telescope	Diploma
Microscope	Diploma
Thermometers	Diploma
Barometer	Diploma
Set of globes for school use	Diploma
Set of mathematical solids	Diploma
Display of chemicals	Diploma
Display of dyes	Diploma
Display of medicinal drugs	Diploma
Display of fine perfumery	Diploma

K—CLASS 51.—CLOCKS, JEWELRY, PLATED WARE, CUTLERY, ETC.

Best exhibition of clocks for household use or parlor ornament	Diploma and	$5 00
Best exhibition of silver or plated ware	Diploma and	5 00
Best exhibition of table cutlery	Diploma and	2 00
Best display of American watches		Diploma
Best exhibition of Britannia ware		3 00
Best case of jewelry		Diploma
Best case of gold pens		Diploma
Best and most elegant skates		Diploma
Best exhibition of bronze ware		Diploma
Best exhibition of fancy glassware		Diploma

K—CLASS 52.—ARTICLES OF LADIES' DRESS.

Best ladies' walking dress	$5 00
Second best ladies' walking dress	3 00
Best display millinery goods	5 00
Second best display millinery goods	3 00
Best trimmed lady's hat	3 00
Second best trimmed lady's hat	2 00
Best trimmed bonnet	3 00
Second best trimmed bonnet	2 00
Best trimmed straw hat	2 00
Second best trimmed straw hat	1 00
Best evening dress	3 00
Second best evening dress	2 00
Best skirt	2 00
Second best skirt	1 00
Best suit of under garments	3 00
Second best suit of under garments	2 00
Best set of under-sleeves and collar	2 00
Second best set of under-sleeves and collar	1 00
Best hoop skirt	2 00
Second best hoop skirt	1 00
Best hoop-skirt bustle	2 00
Second best hoop-skirt bustle	1 00
Best corset	2 00
Second best corset	1 00
Best cloak	2 00
Second best cloak	1 00
Best waterproof	2 00
Second best waterproof	1 00
Best misses' suit	3 00
Second best misses' suit	2 00
Best infant suit	2 00
Second best infant suit	1 00
Best set lady's furs	5 00
Second best set lady's furs	3 00
Best pair lady's fur gloves	2 00
Second best pair lady's fur gloves	1 00
Best lady's fur muff	2 00
Second best lady's fur muff	1 00

Best lady's fur cape	$2 00
Second best lady's fur cape	1 00
Greatest display of ladies' dress goods	Diploma

K—CLASS 53.—PLAIN NEEDLE AND MACHINE WORK.

Best specimen of plain needle work	$3 00
Second best specimen of plain needle work	2 00
Best fine shirt, all by hand	2 00
Second best fine shirt, all by hand	1 00
Best fine skirt, all by hand	2 00
Second best fine skirt, all by hand	1 00
Best pair of plain handkerchiefs	2 00
Second best pair of plain handkerchiefs	1 00
Best silk patchwork quilt, by hand	3 00
Second best silk patchwork quilt, by hand	2 00
Best calico patchwork quilt, by hand	3 00
Second best calico patchwork quilt, by hand	2 00
Best worsted patchwork quilt, by hand	3 00
Second best worsted patchwork quilt, by hand	2 00
Best plain white muslin quilt, by hand	3 00
Second best plain white muslin quilt, by hand	2 00
Best plain quilt of any other kind, by hand	3 00
Second best plain quilt of any other kind, by hand	2 00
Best pair of plain sheets, by hand	2 00
Second best pair of plain sheets, by hand	1 00
Best pair of plain pillow-cases or covers	2 00
Second best pair of plain pillow-cases or covers	1 00
Best set pillow shams	2 00
Second best set pillow shams	1 00
Best sample brading, by hand	2 00
Second best sample brading, by hand	1 00
Best specimen of hem stitching	2 00
Second best specimen of hem stitching	1 00
Best plain sewing, by a girl under 14	2 00
Second best plain sewing, by a girl under 14	1 00
Best sample of patched garment	2 00
Second best sample of patched garment	1 00
Best darned stocking	2 00
Second best darned stocking	1 00
Best ironed and done-up shirt	2 00
Second best ironed and done-up shirt	1 00
Best plain sewing by machine	3 00
Second best plain sewing by machine	2 00
Best fine shirt by machine	2 00
Second best fine shirt by machine	1 00
Best fine skirt by machine	2 00
Second best fine skirt by machine	1 00
Best infant's dress and skirt by machine	2 00
Second best infant's dress and skirt by machine	1 00
Best sample ornamental work by machine	3 00
Second best sample ornamental work by machine	2 00
Best bed-quilt made and quilted by machine	3 00
Second best bed-quilt made and quilted by machine	2 00
Best sample braiding by machine	2 00
Second best sample braiding by machine	1 00
Best other work by machine	2 00
Second best other work by machine	1 00

Machine work must be done by ladies, not machine agents.

K—CLASS 54.—EMBROIDERY AND ORNAMENTAL NEEDLEWORK.

Best and largest collection of ornamental needlework or embroidery done by one person	$10 00
Best specimen ornamental needlework in cotton or linen	3 00
Second best specimen ornamental needlework in cotton or linen	2 00
Best specimen embroidered infant's dress or skirt, in cotton or linen	2 00

Second best specimen embroidered infant's dress or skirt, in cotton or linen	$1 00
Best specimen embroidered pillow cases or covers, in cotton or linen	2 00
Second best specimen embroidered pillow cases or covers, in cotton or linen	1 00
Best specimen embroidered lady's skirt, in cotton or linen	2 00
Second best specimen embroidered lady's skirt, in cotton or linen	1 00
Best specimen embroidered lace veil or cape	2 00
Second best specimen embroidered lace veil or cape	1 00
Best specimen embroidered lace curtains	2 00
Second best specimen embroidered lace curtains	1 00
Best specimen embroidered undersleeves, in cotton or linen	2 00
Second best specimen embroidered undersleeves, in cotton or linen	1 00
Best specimen embroidered night dress, in cotton or linen	2 00
Second best specimen embroidered night dress, in cotton or linen	1 00
Best specimen embroidered infant's blanket, in cotton or linen	2 00
Second best specimen embroidered infant's blanket, in cotton or linen	1 00
Best specimen embroidered handkerchief, in cotton or linen	2 00
Second best specimen embroidered handkerchief, in cotton or linen	1 00
Best specimen embroidered letters in marking, in cotton or linen	2 00
Second best specimen embroidered letters in marking, in cotton or linen	1 00
Best set embroidered table mats, in cotton or linen	2 00
Second best set embroidered table mats, in cotton or linen	1 00
Best specimen silk embroidery	3 00
Second best specimen silk embroidery	2 00
Best specimen embroidered infant's dress or skirt, in silk	2 00
Second best specimen embroidered infant's dress or skirt, in silk	1 00
Best specimen embroidered infant's blanket, in silk	2 00
Second best specimen embroidered infant's blanket, in silk	1 00
Best specimen embroidered ottoman or chair cover, in silk	2 00
Second best specimen embroidered ottoman or chair cover, in silk	1 00
Best specimen embroidered piano or table cover, in silk	2 00
Second best specimen embroidered piano or table cover, in silk	1 00
Best specimen embroidered slippers, in silk	2 00
Second best specimen embroidered slippers, in silk	1 00
Best specimen embroidered book mark	2 00
Second best specimen embroidered book mark	1 00
Best specimen embroidered letters in marking, in silk	2 00
Second best specimen embroidered letters in marking, in silk	1 00
Best specimen embroidered dressing gown, in silk	2 00
Second best specimen embroidered dressing gown, in silk	1 00
Best specimen embroidered lady's dress or robe, in silk	2 00
Second best specimen embroidered lady's dress or robe, in silk	1 00
Best specimen chenille embroidery in silk	2 00
Second best specimen chenille embroidery in silk	1 00
Best sample worsted embroidery	3 00
Second best sample worsted embroidery	2 00
Best sample pictures worked in worsted	3 00
Second best sample pictures worked in worsted	2 00
Best sample cut or raised work, in worsted	2 00
Second best sample cut or raised work, in worsted	1 00
Best sample pair toilet mats in worsted	2 00
Second best sample pair toilet mats in worsted	1 00
Best sample pair lamp mats in worsted	2 00
Second best sample pair lamp mats in worsted	1 00
Best sample toilet cushion, in worsted	2 00
Second best sample toilet cushion, in worsted	1 00
Best sample chair or ottoman cover, in worsted	2 00
Second best sample chair or ottoman cover, in worsted	1 00
Best sample pair slippers	2 00
Second best sample pair slippers	1 00
Best sample embroidered table or piano spread, in worsted	2 00
Second best sample embroidered table or piano spread, in worsted	1 00
Best sample embroidered sofa or pillow cover, in worsted	2 00
Second best sample embroidered sofa or pillow cover, in worsted	1 00
Best sample work on perforated board, in worsted	2 00
Second best sample work on perforated board, in worsted	1 00

Best sample chair tidy, in worsted	$2 00
Second best sample chair tidy, in worsted	1 00
Best sample towel rack	2 00
Second best sample towel rack	1 00
Best sample stool cover	2 00
Second best sample stool cover	1 00
Best sample embroidered bracket	2 00
Second best sample embroidered bracket	1 00
Best sample embroidered wall basket	2 00
Second best sample embroidered wall basket	1 00

K—CLASS 55.—CROCHET, KNIT, AND FANCY WORK.

Largest and best collection of work in this class made by one person	$5 00
Best display of crochet articles	3 00
Second best display of crochet articles	2 00
Best gent's scarf	2 00
Second best gent's scarf	1 00
Best afghan robe	3 00
Second best afghan robe	2 00
Best child's afghan robe	3 00
Second best child's afghan robe	2 00
Best cotton tidy	2 00
Second best cotton tidy	1 00
Best worsted tidy	2 00
Second best worsted tidy	1 00
Best pair crochet toilet mats	2 00
Second best pair crochet toilet mats	1 00
Best pair crochet lamp mats	2 00
Second best pair crochet lamp mats	1 00
Best crochet collar	2 00
Second best crochet collar	1 00
Best crochet or knit hood	2 00
Second best crochet or knit hood	1 00
Best crochet or knit bedspread	3 00
Second best crochet or knit bedspread	2 00
Best crochet or knit shawl	2 00
Second best crochet or knit shawl	1 00
Best crochet or knit flag	2 00
Second best crochet or knit flag	1 00
Best crochet or knit lady's sack	2 00
Second best crochet or knit lady's sack	1 00
Best crochet or knit child's sack	2 00
Second best crochet or knit child's sack	1 00
Best crochet or knit infant's boots	2 00
Second best crochet or knit infant's boots	1 00
Best crochet or knit infant's shirt	2 00
Second best crochet or knit infant's shirt	1 00
Best crochet or knit leggings	2 00
Second best crochet or knit leggings	1 00
Best crochet or knit mittens	2 00
Second best crochet or knit mittens	1 00
Best crochet or knit child's cap	2 00
Second best crochet or knit child's cap	1 00
Best sample plain knitting	2 00
Second best sample plain knitting	1 00
Best sample ornamental knitting	2 00
Second best sample ornamental knitting	1 00
Best crochet or knit cloak	2 00
Second best crochet or knit cloak	1 00
Best fancy pin cushion	2 00
Second best fancy pin cushion	1 00
Best fancy purse	2 00
Second best fancy purse	1 00
Best fancy pen-wiper	2 00
Second best fancy pen-wiper	1 00

Best fancy bead-worked hanging basket	$2 00
Second best fancy bead worked hanging basket	1 00
Best fancy bead cushion	2 00
Second best fancy bead cushion	1 00
Best fancy bead book mark	1 00
Second best fancy bead book mark	50

K—CLASS 56.—HAIR, SHELL, AND WAX WORK.

Best and largest display of hair work	$3 00
Second best and largest display of hair work	2 00
Best specimen of hair flowers	2 00
Second best specimen of hair flowers	1 00
Best specimen hair embroidery	2 00
Second best specimen hair embroidery	1 00
Best hair wreath	2 00
Second best hair wreath	1 00
Best display of wax work	3 00
Second best display of wax work	2 00
Best display of wax flowers in vase	2 00
Second best display of wax flowers in vase	1 00
Best display of wax flowers in wreath	2 00
Second best display of wax flowers in wreath	1 00
Best display of fruit in wax	3 00
Second best display of fruit in wax	2 00
Best artificial flowers in silk, muslin, paper, or feathers, each	2 00
Second best artificial flowers in silk, muslin, paper, or feathers, each	1 00
Best wreath of artificial flowers	2 00
Second best wreath of artificial flowers	1 00
Best specimen worsted or chenille flowers	2 00
Second best specimen worsted or chenille flowers	1 00
Best display of fancy papier-mache work	2 00
Second best display of fancy papier-mache work	1 00
Best ornamental shell work	2 00
Second best ornamental shell work	1 00
Best shell frame	2 00
Second best shell frame	1 00
Best corn frame	2 00
Second best corn frame	1 00
Best wreath of shell or seed flowers	2 00
Second best wreath of shell or seed flowers	1 00
Best wreath of dried grasses and plants	2 00
Second best wreath of dried grasses and plants	1 00
Best bouquet of dried grasses and plants	2 00
Second best bouquet of dried grasses and plants	1 00
Best specimen of fancy leather work	2 00
Second best specimen of fancy leather work	1 00
Best display of hair-dresser's work	Diploma

K—CLASS 57.—PRINTING AND STATIONERY.

Committe to be appointed by the President or Executive Committee.

Best bound and printed set of school books	Diploma
Best specimen of cloth binding	Diploma
Best specimen of leather binding	Diploma
Best specimen of book printing	Diploma
Best set of blank books	Diploma
Best specimen of poster printing	Diploma
Best specimen of pamphlet printing	Diploma
Best specimen of card and bill printing	Diploma
Best specimen of ornamental printing	Diploma
Best set of outline maps	Diploma
Best display of fine stationery	Diploma
Best paper made from straw	Diploma
Best paper made from rags	Diploma
Bast paper made from other material	Diploma
Best paper made for newspaper work	Diploma
File of best arranged and printed local newspaper	Diploma

Best local notice of the coming fair of 1875	$50 00
Second best local notice of the coming fair of 1875	30 00
Third best local notice of the coming fair of 1875	20 00

Publishers of newspapers competing for the above local notice premiums, will forward a copy of the paper containing such notice to the Secretary, C. F. Kimball. Pontiac, Mich., till Sept. 1, 1875, after which date to Secretary's office at East Saginaw,

N. B.—All diplomas should be applied for at the office of the Society, at Pontiac. If not applied for they will be sent by express on notification of address when it is possible to do so.

MISCELLANEOUS DIVISION.

Superintendent—John P. Allison, East Saginaw.

L—CLASS 58.—MISCELLANEOUS ARTICLES.

Best collection of work in marble	Diploma and	$5 00
Best specimen of steel manufactured in the State		Medal
Best specimen of glass manufactured in the State		Medal
Best specimen of brass manufactured in the State		Medal
Best specimen of sawed lumber, not less than twenty boards, different varieties	Diploma and	$2 00
Best specimen of dressed lumber, not less than fifteen boards, different varieties	Diploma and	2 00
Best thousand white pine shingles, hand made		3 00
Best thousand of machine made shingles	Diploma and	2 00
Best collection of ten bunches of sawed lath		3 00
Best collection of fire brick		Diploma
Best collection of building stone, natural		Diploma
Best specimen one barrel stone lime		$2 00
Best specimen one barrel marl lime		2 00
Best specimen one barrel water lime		2 00
Best specimen one barrel stucco lime		2 00
Best specimen building paper		Diploma
Best specimen concrete roofing		Diploma
Best specimen super-phosphate		Diploma
Best specimen ground bone		$5 00
Best barrel fine salt		5 00
Best barrel packer's salt		5 00
Best sample table salt		5 00
Best fine kettle salt		5 00
Best solar salt		5 00
Best wrought iron fence, of Michigan manufacture		Silver medal
Best church bell		Diploma
Best steamboat bell		Diploma
Best locomotive bell		Diploma
Best hotel signal		Diploma
Best horse shoes, not less than three in number of each of the following kinds, viz.: plates, trotting shoes, bow shoes, shoes for general purposes and for heavy work		$10 00
For the second best		5 00
Best shod horse		10 00
Second best shod horse		5 00
Best specimen of native copper, from mines in the State	Diploma and	2 00
Best specimen of iron ore, from mines in the State	Diploma and	2 00
Best specimen of silver ore, from mines in the State	Diploma and	2 00
Best specimen of bituminous coa,l from quarry in the State	Diploma and	2 00
Best specimen of anthracite coal, from quarry in the State	Diploma and	2 00
Best specimen of stone plaster, from quarry in the State	Diploma and	2 00
Best barrel of ground plaster, from quarry in the State	Diploma and	2 00
Best prepared drain, not less than two rods in length, upon the fair grounds, showing the drain neatly excavated, the tile laid down, the tile prepared for covering with earth, and a section completely covered, having the discharge open at the end, the exhibitors furnishing a statement of the cost of the tile, expense of preparation, etc., the drain not less than three feet deep, premium of		10 00

Best set of tools used in digging ditch, and laying the tile, premium of........ $3 00
Best machine for making tile, to be exhibited in complete working order and operation........Diploma and 10 00
Best self-operating swing........Diploma
Best lightning conductor........Diploma
Best specimen of concrete or artificial stone........Diploma
Best specimen of bricks made by hand or machinery........Diploma
Best and finest specimen of wood turning........Diploma
Best specimen of mineral paint........Diploma
Best cement roofing........Medal

EXECUTIVE COMMITTEE MEETING.

Tuesday Evening, Sept. 13, 1875.

Committee met at the Secretary's office, on the fair grounds. Called to order by President Humphrey. Roll called, and the following gentlemen answered to their names: Messrs. Burrington, Blodgett, Childs, Manning, Allison, Hanford, Phillips, Rising, Sterling, Ferry, Hyde, Baxter, the President, and the Secretary. On motion the Business Committee were authorized to employ a 'bus to transport the members of the Executive Committee from the Bancroft House to the fair grounds, at 7½ o'clock each morning.

The question as to what shall constitute a herd of grade cattle was brought up in connection with the entry of the calf herd of Mr. Ryerson of Hastings, when, on motion, the subject was referred to a committee consisting of Messrs. Phillips, Hanford, and Howard.

The matter of premiums to pieces of machinery which involve in their operation other pieces, was discussed, and on motion of Mr. Baxter the following constructive resolution was adopted:

Resolved, That the rule forbidding the entry of the same articles in different classes or for more than one premium shall not be so construed as to prevent the entry of articles of machinery for which premiums are offered when separate from being also entered in combination with other articles as a distinct and complete machine.

On motion, collection of entrance fees on sweepstakes in draft trials was ordered.

On motion adjourned.

Tuesday Evening, Sept. 14, 1875.

Called to order by the President. Roll called: quorum present. Minutes read and approved.

The committee to whom was referred the question, "What shall constitute a grade herd?" reported as follows, which was adopted:

Your committee to whom was referred the question of what should constitute a herd in herd No. 2, Class 10, would respectfully report that said herd shall consist of five head from any thoroughbred bull, without regard to age or sex; and we would recommend that the said herd and premium in Class 10 be stricken out at the next winter meeting.

G. W. PHILLIPS,
H. O. HANFORD,
D. W. HOWARD.

The matter of holding meetings, whether on the fair grounds or in the city, was under discussion, when Mr. Sterling moved that business meetings of the Executive Committee be held at the Secretary's office on the fair grounds, which motion was adopted and ordered so published.

Adjourned.

ANNUAL MEETING.

Thursday Evening, Sept. 16.

Meeting called to order at 7 o'clock P. M. at the Secretary's office. The office was literally packed. It was impossible for the Secretary to make or keep a record of the proceedings, and after much discussion the meeting was declared adjourned to the Episcopal Eating House under the grand stand, whither the crowd repaired. It was moved and adopted that the President appoint a committee of one from each Congressional district to nominate officers for the coming year, they to report at an adjourned meeting to be held on the grand stand at 9 o'clock A. M. to-morrow—Friday. The President appointed the following nominating committee:

1st—Robert Gibbons, Wayne;
2d—Geo. C. Munroe, Hillsdale;
3d—A. O. Hyde, Calhoun;
4th—J. J. Woodman, Van Buren;
5th—Henry Fralick, Kent;
6th—A. B. Gulley, Ingham;
7th—A. S. Stebbins, St. Clair;
8th—Geo. L. Burrows, Saginaw;
9th—Geo. Parmalee, Grand Traverse.

Whereupon the meeting adjourned.

Friday Morning, 9 A. M.

The adjourned meeting of the Michigan State Agricultural Society was called to order promptly at 9 o'clock, when the Nominating Committee made their report, which on motion was laid upon the table.

On motion, proceeded to elect a President, Secretary, and Treasurer by ballot.

The following tellers were appointed: M. E. Crofoot, Pontiac; Charles D. Little, Saginaw; W. J. Baxter, Jonesville; F. M. Manning, Paw Paw.

VOTE FOR PRESIDENT.

E. O. Humphrey, Kalamazoo	250
Charles Kipp, St. Johns	244

VOTE FOR SECRETARY.

Charles F. Kimball, Pontiac	247
J. P. Thompson, Ada	226

VOTE FOR TREASURER.

A. J. Dean, Adrian	279
N. L. Avery, Grand Rapids	167

On motion the following members of the Executive Committee were elected:

Abel Angel, Bradley, Allegan county;
J. Q. A. Burrington, Worth, Tuscola county;
J. Webster Childs, Ypsilanti, Washtenaw county;
D. W. Howard, Pentwater, Oceana county;
R. G. Hart, Lapeer, Lapeer county;
H. O. Hanford, Plymouth, Wayne county;

F. M. Manning, Paw Paw, Van Buren county;
E. Van Valkenburgh, Hillsdale, Hillsdale county;
William L. Webber, East Saginaw, Saginaw county;
Amos F. Wood, Mason, Ingham county.

Hon. R. E. Trowbridge, of Ingham, offered the following resolutions, which after discussion were unanimously adopted, prescribing the time and manner of electing the officers of this Society:

Resolved, That in all future elections for officers of this Society the election shall be conducted in the following manner, viz.: The Executive Committee shall provide a proper ballot-box, to be kept at some convenient place on the fair grounds, and they shall appoint three proper persons who shall conduct the election and receive the ballots of all members who are entitled and shall offer to vote, and said judges shall require each person offering to vote to present the proper certificate of membership, and shall keep a full register of the names of all persons voting at such election. The polls of said election shall be opened at 9 o'clock A. M. and closed at 5 o'clock P. M. on Thursday of the week of the annual fair. In case of a tie vote the judges shall decide the matter in the manner provided by law for deciding tie votes at township elections. The judges of the election, together with the President of the Society, shall duly canvass the votes so cast, and shall publicly announce the result from the grand stand on the fair grounds at 10 o'clock A. M. of the next succeeding day; and be it further

Resolved, That due notice of such election shall annually be given by the Secretary in the posters and regular advertisements of the fair, and conspicuous notices of the place where such polls shall be held shall also be posted on the grounds.

On motion, adjourned *sine die*.

C. F. KIMBALL, *Secretary*.

Friday Morning, September 17,—11 o'clock.

A special meeting of the Executive Committee was held to consider the question of continuing the fair through Saturday, when, on motion, it was decided that such of the speed trials as were unfinished on Friday evening should be completed on Saturday, and that such committee work as was incomplete should be completed on Saturday forenoon.

Adjourned to meet at the Bancroft House this (Friday) evening at 8 o'clock, to consider centennial matters.

Met at Bancroft House pursuant to adjournment. Roll called: quorum present.

Mr. Woodman, Chairman of the State Centennial Board, addressed the Committee, and announced the following division as having been made of the different interests to be represented at the centennial of 1876, from Michigan, with the view of thoroughly canvassing each and every department, so that our representation of the resources and products shall be a credit to the State and a glorious and lasting remembrance for generations to come.

Education, arts, and science have been assigned under the supervision of Gov. J. J. Bagley, President of the Centennial Board, assisted by the State Superintendent of Public Instruction and such other assistance as desired.

The mineral resources are under the supervision of Hon. J. A. Hubbell, commissioner of the board, assisted in the lower peninsula by S. S. Garrigues of Saginaw.

The soils, grapes, woods, and horticultural department, the products of the Agricultural College farm and museum, to the Agricultural College.

The Pomological society, the board are desirous should take charge of the

fruits, collect, forward, and superintend the detail and exhibition of that department. The Agricultural Society are asked to take charge of the agricultural department, and under the superintendence of the commissioners of the State Centennial Board aid in the collecting, classifying, and exhibiting all the products and resources of the soil, and mechanical or manufacturing departments not otherwise provided for.

J. J. Woodman assigned to the general charge of the department of agriculture.

Henry Fralick and M. I. Mills to department of machinery and manufacturing.

The sub-committee to whom the matter was referred made the following report, which, after much discussion, was adopted:

Your committee report the proposition of the Centennial Board and move its adoption; and your committee recommend that such appointment and action be taken by the State Agricultural Society as shall fully carry out the request made by the Centennial Board, and that there is hereby appropriated for actual expenses the sum of two thousand dollars; *Provided*, That no person engaged or appointed for the service of the Society shall receive compensation for time.

The Executive Committee then adjourned to meet at the fair grounds to-day at nine o'clock, and conclude the business of the fair.

Saturday Morning, Sept. 18.

Meeting called to order at 9 o'clock.

Roll called: quorum present.

The several protests filed during the fair, being defective and informal, were rejected.

Mr. Baxter offered the following resolution, which was unanimously adopted:

Resolved, That the thanks of the Michigan State Agricultural Society are fully due, and are hereby tendered to gentlemen controlling the following railroads in this State for their uniform courtesy and dispatch in meeting the many and onerous requirements attending the transportation of stock, implements, etc., to and from the State Fair; that in all cases coming to our knowledge every engagement has been fully carried out, both in letter and spirit: Michigan Central R. R. and branches, F. & P. M., D. & M., D., L., & L. M., C. & L. H., Ft. W., J. & S., G. R. & I., C. & M. L. S., S. V. & St. L., D. & B. C., J., L. & S., and G. R. V.; and we do hereby recognize the liberal spirit manifested by them to the people of the State in forwarding to and returning from the fair all stock, implements, etc., *free of charge*. We regret that we cannot include the Lake Shore & Michigan Southern R. R. as one of the above list. Especially do we feel it due to the management of the Flint & Pere Marquette R. R. for the attention and uniform dispatch given to the interests of the fair, as the position of this road relative to the fair grounds is an exceptional one, having the additional duty of receiving from all other roads and running such transportation to East Saginaw and the fair grounds, also the special conveniences they have generously afforded for the use of the fair in laying special tracks to and into the grounds, and to localities most convenient for handling and receiving the vast amount of exhibitory material, and to the comfort and satisfaction of the many thousands of our people who have attended this State Fair.

Mr. Childs moved a re-consideration of the vote of last evening, by which an appropriation of two thousand (2,000) dollars was made for expenses of the Centennial, which being supported, and the ayes and nays being called, the motion was declared carried.

No quorum being present, adjourned *sine die*.

C. F. KIMBALL, *Secretary*.

STATE FAIR PREMIUMS.

OFFICIAL LIST OF PREMIUMS AWARDED BY THE MICHIGAN STATE AGRICULTURAL SOCIETY, AT THE 27TH ANNUAL FAIR, HELD AT EAST SAGINAW, SEPT. 13TH TO 17TH, 1875.

DIVISION A.

CLASS 1—SHORTHORNS.

Bulls.

Four years or over—Hotspur 5th, Thomas Wood, Saline, 1st	$40 00
Three years—8th Earl Lakeview, A. H. & E. L. Smith, Kalamazoo, 1st	30 00
——, Ezra Mead, Grand Blanc, 2d	15 00
Dickens, D. McComber, Hastings, 3d	8 00
Two years—Duke, D. M. Uhl, Ypsilanti, 1st	20 00
Hector, Thos. Altoft, Hastings, 2d	10 00
John Anderson, Norman L. Miller, Saginaw City, 3d	5 00
One year—4th Fordham, Duke of Oxford, Avery & Murphy, Port Huron, 1st	10 00
Corporal 2d, Wm. T. Johnston, Northville, 2d	5 00
Granger, James Moore, Milford, 3d	3 00
Calf, 7 months—Wild Eyes, Avery & Murphy, Port Huron, 1st	10 00
Calf, 7 months—St. Valentine, Avery & Murphy, Port Huron, 2d	5 00
Calf, 5 months—Duke of Brookside, D. M. Uhl, Ypsilanti, 3d	3 00
Of any age—8th Earl of Lakeview, A. H. & E. L. Smith, Kalamazoo, 1st	Diploma

Cows.

Four years or over—Peri 3d, Avery & Murphy, Port Huron, 1st	$40 00
Young Florence, D. M. Uhl, Ypsilanti, 2d	20 00
——, Wm. Hamilton, Flint, 3d	10 00
Three years—Oxford's Vanquish 4th, Avery & Murphy, Port Huron, 1st	30 00
Brookside Beauty, D. M. Uhl, Ypsilanti, 2d	15 00
Queen of Maple Banks 1st, Wm. T. Johnson, Northville, 3d	8 00
Two years—Cambria 7th, Avery & Murphy, Port Huron, 1st	15 00
Wayne Rose 2d, Wm. T. Johnson, Northville, 2d	8 00
2d Queen of Maple Banks, Wm. T. Johnson, Northville, 3d	3 00
Yearling—Oxford's Vanquish 5th, Avery and Murphy, Port Huron, 1st	10 00
——, Wm. Hamilton, Flint, 2d	5 00
——, Wm. Hamilton, Flint, 3d	3 00
Calf—Oxford's Vanquish 6th, Avery & Murphy, Port Huron, 1st	10 00
Calf, 6 months—James Moore, Milford, 2d	5 00
Calf, 6 months—James Moore, Milford, 3d	3 00

Bull "Rufus," belonging to the Agricultural College, was far superior in the class of two-year-olds, and we looked upon him as a first-class animal.

Through their agent, Mr. Stebbins, Avery & Murphy withdrew two cows which were on exhibition for prizes, which no doubt would have been worthy of awards if in competition.

Two cows, also shown from the State Farm, being useful ones, one being worthy of third premium in the class after Avery & Murphy withdrew.

Two heifers shown in the two-year-old class, from the State Farm, being good ones—worthy of second and third premiums.

To the Officers of the Michigan State Agricultural Society:

We found in many classes in this division strong competition, and you have reason to be proud of the exhibition.

AMOS F. WOOD,
JOHN MILLER,
Committee.

CLASS 2.—DEVONS.

Bulls.

Four years or over—Arrow Head, P. K. Leach, Utica, 1st	$40 00
Blucher, Frank Tompkins, Girard, 2d	20 00
Prince of Lapeer, C. G. White, Lapeer, 3d	10 00
Three years—Shelby, P. K. Leach, Utica, 1st	30 00
Two years—Ben Butler, P. K. Leach, Utica, 1st premium	20 00
Batavia of Lapeer 2d, C. G. White, Lapeer, 2d	10 00
Calf—Macomb, P. K. Leach, Utica, 1st premium	10 00
St. Patrick, Frank Tompkins, Girard, 2d premium	5 00
Rover, C. G. White, Lapeer, 3d premium	3 00

Cows.

Four years or over—Cherry of Lapeer, C. G. White, Lapeer 2d, 1st premium	$40 00
Nubia, P. K. Leach, Utica, 2d premium	20 00
Cherry of Lapeer, C. G. White, Lapeer, 3d premium	10 00
Three years—Lilly 3d, P. K. Leach, Utica, 1st premium	30 00
Laura 3d, P. K. Leach, Utica, 2d premium	15 00
Two years—Nellie 3d, P. K. Leach, Utica, 1st premium	15 00
Lily, C. G. White, Lapeer, 2d premium	8 00
Princess of Meridian, Frank Tompkins, Girard, 3d premium	3 00
Yearling—Lily 5th, P. K. Leach, Utica, 1st premium	10 00
Roselin, Frank Tompkins, Girard, 2d premium	5 00
Cherry of Lapeer 5th, C. G. White, Lapeer, 3d premium	3 00
Calf—Nora 2d, P. K. Leach, Utica, 1st premium	10 00
Red Bird, C. G. White, Lapeer, 2d premium	5 00
Lucy, Frank Tompkins, Girard, 3d premium	3 00

There were two first-class heifers from the College Farm, and one third-class.

WM. H. SOTHAM,
H. SCHRAM,
B. F. PROCTOR,
Committee.

CLASS 3.—HEREFORDS.

Bulls.

Four years or over—Harry, W. W. Crapo, Flint, 1st premium	$40 00
Three years—Royal Lad, Edwin Phelps, Pontiac, 2d premium	15 00
Yearling—Vigilant, W. W. Crapo, Flint, 2d premium	5 00
Calf—Virgil, W. W. Crapo, Flint, 1st premium	10 00

Cows.

Four years or over—Rosie, W. W. Crapo, Flint, 1st premium	40 00
Vanquish 2d, W. W. Crapo, Flint, 2d premium	20 00
First Rose of Michigan, Edwin Phelps, Pontiac, 3d premium	10 00
Three years—Lettie, W. W. Crapo, Flint, 1st premium	30 00
May, W. W. Crapo, Flint, 2d premium	15 00
Two years—Daisy, W. W. Crapo, Flint, 1st premium	15 00
Essie, W. W. Crapo, Flint, 2d premium	8 00
Yearling—Fairy, W. W. Crapo, Flint, 1st premium	10 00
Third Rose of Michigan, Edwin Phelps, Pontiac, 3d premium	3 00
Calf—Fourth Rose of Michigan, Edwin Phelps, Pontiac, 1st premium	10 00

WM. HAMILTON,
JAMES MOORE,
RUFUS PIERSON,
Committee.

CLASS 4.—AYRSHIRES.

Bulls.

Four years or over—Bannock, Alex. McKell, East Saginaw, 1st premium	$30 00
Yearling—Wallace, Alex. McKell, East Saginaw, 1st premium	8 00
Calf—Roger, Alex. McKell, East Saginaw, 1st premium	4 00
Bonnie Doon, L. B. Potter, Lansing, 2d	2 00

Cows.

Four years or over—Nettie 3d, L. B. Potter, Lansing, 1st premium	$30 00
Princess, Wm. L. Webber, East Saginaw, 2d premium	20 00
Beatrice, Wm. L. Webber, East Saginaw, 3d premium	10 00
Two years—Ellen, Alex. McKell, East Saginaw, 1st premium	10 00
Yearling—Wm. L. Webber, East Saginaw, 1st premium	8 00
Pluming, Alex. McKell, East Saginaw, 2d premium	4 00
Calf—Lena, Alex. McKell, East Saginaw, 1st premium	4 00
Mabel, Alex. McKell, East Saginaw, 2d premium	2 00

In the class for four-year-old bulls we find the bull "Dundee," from the Agricultural College, superior to any entered under that heading; also in the class for one-year-old heifers, College cow Blink Bonney superior to any on the ground. College heifer Lettie, three-year-old, also superior to any on the ground.

A. B. GULLEY,
ERASTUS DAY,
B. SUTHERLAND,
B. F. PROCTOR,
Committee.

CLASS 5.—ALDERNEYS AND JERSEYS.

Bulls.

Four years or over—(Jersey) Jay S. Curtis, East Saginaw, 1st premium	$30 00

Cows.

Four years or over—(Jersey) J. S. Curtiss, East Saginaw, 1st premium	$30 00
(Jersey) J. S. Curtiss, East Saginaw, 2d	20 00
Two years—(Jersey) J. S. Curtiss, East Saginaw, 1st premium	10 00
Yearling—(Jersey) Jay S. Curtiss, East Saginaw, 1st premium	8 00

One cow in this class (cow four years old), exhibited by the State Agricultural College, being a fine specimen and worthy of first premium in her class.

E. DENNIS,
WM. WHITFIELD,
TOMPKINS BUCKBEE,
Committee.

CLASS 6.—GALLOWAYS.

Bulls.

Three years—R. G. Hart, Lapeer, 1st premium	$20 00
Calf—R. G. Hart, Lapeer, 2d premium	2 00

Cows.

Four years or over—R. G. Hart, Lapeer, 1st premium	$30 00
Two years—R. G. Hart, Lapeer, 1st premium	10 00
Calf—R. G. Hart, Lapeer, 1st premium	4 00

JOHN McKAY,
JOHN C. THOMPSON,
A. J. SIKES,
Committee.

CLASS 7.—GRADE OR NATIVE CATTLE.

Bulls.

Of any age—Abram Ryerson, Hastings, 1st premium	Diploma

Cows.

Four years or over—Frank Willson, Jackson, 1st premium	$20 00
Triplet cows, Mrs. Wm. H. Beach, East Saginaw, 2d premium	10 00
Beauty, E. T. Doney, Jackson, 3d premium	5 00
Three years—Frank Willson, Jackson, 1st premium	15 00
Yearling—Frank Willson, Jackson, 1st premium	8 00
Samuel Aplin, Jr., Flint, 2d premium	5 00
Calf—Abram Ryerson, Hastings, 1st premium	5 00
Calf, 7 months—Mrs. R. A. Gardner, East Saginaw, 2d premium	3 00

DENNIS WOLVERTON,
A. S. BROOKS,
E. H. HUME,
Committee.

CLASS 8.—WORKING OXEN AND STEERS.

Yoke of oxen, 5 years or over—A. C. Osborne, Kelley's Corners, 1st premium	$25 00
J. M. Armstrong, Nankin, 2d premium	20 00
Dennis Bow, Bridgeport, 3d premium	15 00
Yoke steers, 4 years—John Bowers, Homer, 1st premium	15 00
Trainer of the best exhibition of trained stock, A. C. Osborne, Kelley's Corners, 1st premium	5 00

HENRY McKAY,
ED. McGUNAGLE,
Committee.

CLASS 9.—FAT CATTLE.

Herd of fat cattle (4), C. J. Sprague, Farmington, 1st premium	$75 00
Pair fat oxen, E. McGunagle, Clarkston, 1st premium	30 00
C. J. Sprague, Farmington, 2d premium	20 00
Fat ox, C. J. Sprague, Farmington, 1st premium	15 00
C. J. Sprague, Farmington, 2d premium	10 00
Fat cow, 4 years—Moss Rose, Wm. T. Johnson, Northville, 1st premium	15 00

CHARLES ULBRIGHT,
JOHN MILLER,
WM. WHITFIELD,
Committee.

CLASS 10.—HERDS AND SWEEPSTAKES.

Herd thoroughbred Shorthorns, Avery & Murphy, Port Huron, 1st premium	$100 00
D. M. Uhl, Ypsilanti, 2d premium	80 00
Wm. T. Johnson, Northville, 3d premium	60 00
Herd graded cattle, 5 in number (Durham)—Abram Ryerson, Hastings, 1st premium	20 00

The following is a classified list of stock exhibited (not in competition) by the State Agricultural College Farm, which stock is highly eulogised by the several awarding committees:

Division A, Class 1—Shorthorns.—Bull Rufus, 2 years old; cows Hero 6, Comaly 4, and heifers Enid and Hela, 2.

Class 2—Devons.—Cow Evelina, 9 years old, and heifers Nameless 2, Ernestine 1.

Class 4—Ayrshires.—Bull Dundee, 8 years old; Blinkbonny 5, heifers Leto 3, and Susie Stewart, 1 year.

Class 5.—Bull Saginaw, 1 year old; cow Jersey 5.

Class 6—Galloways.—Bull Johnny Scott, 4 years old, and cow Snowball 5; heifer Sunflower 1.

Class 7—Grades.—Fanny 2d, 8 years old, Fanny 3d, 7, heifer No. 46, 2 years old.

Class 10—Shorthorn Herd.—Bull Rufus, four cows and heifers.

Division 6, Class 20—Southdowns—Yearling buck and seven ewes.

Class 21—Black-faced Highland Sheep.—Buck and ewe (yearling).

I. H. BUTTERFIELD, JR.,
JOHN MILLER,
C. C. BEAHAN,
Committee.

DIVISION B.—HORSES.

CLASS 11.—THOROUGHBREDS.

Stallions.

Four years old or over—Rook Mirandi, Ralph Fields, Owosso, 1st premium	$50 00
Albert Draper, Foster & Nye, Flint, 2d premium	25 00
Twenty-one years old—Capt. Buford, P. B. Richardson, Tuscola, 3d premium	15 00
Three years old—Prince Eugene, J. C. Deyo, Jackson, 1st premium	20 00

Mares.

Four years old or over foal by side—Julia Drake, Dewey & Stewart, Owosso, 1st premium	$20 00
Without colt—Victorine, A. Van Slyke, Flint, 1st premium	15 00

CLASS 11—PONY CLASS.

Stallion 5 years old (imp.)—Royal Charlie, A. L. Stebbins, Port Huron. Discretionary.
Two years old (imp.)—Scottish Chief, A. L. Stebbins, Port Huron..... Discretionary.
Mare 5 years old (imp.)—Scottish Maid, A. L. Stebbins, Port Huron... Discretionary
Gelding 6 years old (imp.)—Scotchman, A. L. Stebbins, Port Huron... Discretionary.
Gelding 6 years old (imp.)—Tommie, A. L. Stebbins, Port Huron...... Discretionary.

T. D. DEWEY,
A. O. HYDE,
Committee.

CLASS 12—HORSES OF ALL WORK.

Stallions.

Five years or over—Hero (Hambletonian) J. C. Bonnell, Jackson, 1st premium	$50 00
Joseph Young, North Branch, 2d premium	25 00
Shakespeare, Robert Moore, Adrian, 3d premium	15 00
Four years old—E. A. Cummer, Chatham, Ont., 1st premium	30 00
William Hall, Yew, 2d premium	15 00
Three years old—Frank Moulton, J. C. Deyo, Jackson, 1st premium	20 00
Gelding three years old—Townsend North, Vassar, 2d premium	15 00
Stallion three years old—Marker, Frank L. Skeels, Coldwater, 3d premium	10 00
Two years old—John Layman, Grand Blanc, 1st premium	12 00
Avery & Murphy, Detroit (Clyde) 2d premium	8 00
Ralph Fields, Owosso, 3d premium	5 00
One year old—Chas. Davis, Zilwaukee, 1st premium	10 00

Mares.

Brood mare 4 years or over, with foal by side—R. E. Trowbridge, Lansing, 1st premium to mare, 2d to colt	$20 00
Flora Wildermonth, Dewey & Stewart, Owosso, 2d premium to mare and 1st to colt	15 00
R. E. Trowbridge, Lansing, 3d to mare and colt	10 00
Four years old or over, without colt—C. W. Greene, Farmington, 1st premium	12 00
Mrs. W. H. Beach, East Saginaw, 2d premium	8 00
Three years old—Jessie Clay, J. C. Dayton, Flint, 1st premium	12 00
Miles N. Rouse, East Saginaw, 3d premium	5 00
Two years old—H. Hill, Grand Blanc, 1st premium	10 00
Avery & Murphy, Detroit (Clyde), 2d premium	6 00
Avery & Murphy, Detroit, 3d premium	4 00
Gelding four years old—Bashaw, Avery & Murphy, Detroit, 1st premium	12 00
Avery & Murphy, Detroit (Bashaw) 2d premium	8 00

Matched Horses.

Pair matched horses of all work, five years old or over, speed, size, style, and fitness for carriage or farm work to be the points; weight of each horse to be not less than 1,100 pounds—Jesse Hoyt, East Saginaw, 1st premium	$50 00
W. H. Spencer, North Branch, 2d premium	25 00
W. A. Williams, Saginaw City, 3d premium	15 00
Pair four-year-old horses, matched in color, speed, size, style, and fitness for carriage or farm work—Samuel Crouch, Tecumseh, 1st premium	30 00
Pair matched horses for all work, three years old—Turner and Mate, J. C. Deyo, Jackson, 1st premium	15 00

SAMUEL A. BROWN,
D. HORTON,
JOHN WELCH,
Committee.

CLASS 13—ROADSTERS.

Stallion 5 years old or over—Mambrino Gift, Foster & Nye, Flint, 1st premium.	$50 00
Louis Napoleon, Dewey & Stewart, Owosso, 2d premium	25 00
Magna Charta, Frank L. Skeels, Coldwater, 3d premium	15 00
Stallion 4 years old—Combination, S. A. Brown, Grand Rapids, 1st premium	30 00
Edward Blake, Wm. Bishop, East Saginaw, 2d premium	15 00
J. D. Mizner, Burr Oak, 3d premium	10 00
Gelding 5 years old—Jackson City, J. C. Deyo, Jackson, 1st premium	20 00
J. D. Perry, Redford, 3d premium	10 00

Gelding 3 years old—Frank A. Fisk, A. C. Fisk, Coldwater, 1st premium	$20 00
John S, O. F. Foster, Hudson, 2d premium	15 00
Stallion 3 years old—Dan B. Hibbard, Lewis Pike, Jackson, 1st premium	20 00
Dreadnaught, Samuel Goodwill, Flint, 2d premium	15 00
Andrew DeSell, East Saginaw, 3d premium	10 00
Stallion 2 years old—Joe Gavin, Dewey & Stewart, Owosso, 1st premium	12 00
H. Savage, Spring Lake, 2d premium	8 00
F. A. Brewer, East Saginaw, 3d premium	5 00
Gelding three years old—H. Savage, Spring Lake, 1st premium	12 00
H. Savage, Spring Lake, 2d premium	8 00
Billy Fisk, Dewey & Stewart, Owosso, 3d premium	5 00
Yearling stallion—Geo. Rowell, Bennington, 1st premium	10 00
C. J. Towne, Spring Lake, 2d premium	6 00
Mare four years or over, foal by side—Fanny Mapes, Dewey & Stewart, Owosso, 1st premium, and colt discretionary premium	25 00
Dr. F. B. Galbraith, Pontiac, 2d premium, and colt discretionary premium	15 00
Foster & Nye, Flint, 3d premium	10 00
Mare 4 years old without a colt—Samuel A. Brown, Grand Rapids, 1st prem	12 00
G. N. Hatch, Horton, 2d premium	8 00
C. W. Greene, Farmington, 3d premium	5 00
Mare 3 years old—S. A. Brown, Grand Rapids, 1st premium	10 00
Sunlight, O. M. Sisson, Romeo, 2d premium	6 00
G. N. Hatch, Horton, 3d premium	4 00
Mare 2 years old—Myrtle Bud, J. C. Deyo, Jackson, 1st premium	8 00
Daisy, John Layman, Grand Blanc, 2d premium	5 00
Frank L. Skeels, Coldwater, 3d premium	3 00
Mare one year old—Gift, Foster & Nye, Flint, 1st premium	8 00

Articles not Enumerated.

Span Blackhawk twin yearling mares—George Turnbull, Jay P. O., 1st premium .... Discretionary.
Colt owned by Dewey & Stewart, from Julia Drake, 3d premium for colts.

SAMUEL A. BROWN,
HENRY S. FARGO,
JOHN WELCH,
Committee.

CLASS 14.—GENTLEMEN'S DRIVING HORSES TO ROAD WAGONS.

Pair driving horses, owned and driven by exhibitor: J. C. Dayton, Flint, 1st premium	$50 00
Single gelding—Bay Charlie, Frank L. Skeels, Coldwater, 1st premium	30 00
Single mare—G. G. Hartung, Romeo, 2d premium	20 00
Daniel Schuyler, Jackson, 3d premium	10 00
Single gelding 4 years old—G. N. Hatch, Horton, 2d premium	15 00
Single mare, 4 years old—John Fikes, Fenton, 3d premium	10 00

SAMUEL A. BROWN,
SUMNER HOWARD,
JOHN WELCH,
Committee.

CLASS 15.—DRAUGHT HORSES.

Stallions 4 years old or over—Elisha Lambkin, Brockway, 1st premium	$50 00
Young Netherby, Wm. Cox, Greenfield, 2d premium	30 00
C. K. Eddy, East Saginaw, 3d premium	20 00
Stallion 3 years old—Wm. Cox, Greenfield, 1st premium	30 00
S. A. Barnes, Charlotte, 2d premium	20 00
Young Percheron, Edwin Phelps, Pontiac, 3d premium	10 00
Stallion 2 years old—Abner Lemon, Romeo, 1st premium	20 00
Thomas Hall, Bath, 2d premium	15 00
Colt 1 year old—J. Johnson, Memphis, 1st premium	15 00
David Geddes, Saginaw City, 2d premium	10 00
Sucking colt—Avery & Murphy, Detroit, 1st premium	8 00
Avery & Murphy, Detroit, 2d premium	5 00
Avery & Murphy, Detroit, 3d premium	3 00
Mare 4 years old and over—Avery & Murphy, Detroit, 1st premium	50 00
J. L. Barnard, Saginaw City, 2d premium	30 00
David Geddes, Saginaw City, 3d premium	20 00

Imported draft stallion, of any breed, or bred from imported sire and dam, 4 years or over—Young Richmond, Avery & Murphy, Detroit, 1st premium.. $50 00
Gleniffe, Robert N. Elston, Muskegon, 2d premium........ 30 00
Mark Anthony, R. E. Trowbridge, Lansing, 3d premium........ 20 00

SAMUEL A. BROWN,
DENNIS WOLVERTON,
D. HORTON,
Committee.

CLASS 16.—CARRIAGE AND BUGGY HORSES.

Pair matched carriage horses 16 hands or over and 5 years old or over—L. D. Dewey, Tecumseh, 1st premium........ $50 00
W. H. Jennings, Lapeer, 2d premium........ 25 00
C. L. Benjamin, Saginaw City, 3d premium........ 15 00
Pair matched carriage horses under 16 hands and 4 years old or over—Mrs. S. B. Bliss, East Saginaw, 1st premium........ 40 00
Mrs. O. A. Sears, East Saginaw, 2d premium........ 20 00
L. P. Mason, East Saginaw, 3d premium........ 10 00
Pair matched carriage horses 3 years old—J. C. Deyo, Jackson, 1st premium... 25 00
H. D. Pike, Lapeer, 2d premium........ 15 00
Wm. H. Hood, Palo, 3d premium........ 10 00
Single carriage or buggy horse, 4 years old or over—R. A. Smith, Howell, 1st premium........ 15 00
Single carriage or buggy mare, 3 years old or over—L. P. Mason, East Saginaw, 2d premium........ 10 00
Single carriage mare 3 years old—J. C. Dayton, Flint, 1st premium........ 10 00
Single carriage horse, 3 years old—Dick Lockwood, Dewey & Stewart, Owosso, 2d premium........ 5 00

D. HORTON,
SAMUEL A. BROWN,
JOHN WELCH,
Committee.

CLASS 17.—SADDLE HORSES.

Saddle horse—Dr. P. L. Schuyler, Lansing, 1st premium........ $20 00
Romp, J. C. Deyo, Jackson, 2d premium........ 15 00
Arthur Brown, Bay City, 3d premium........ 10 00

SUMNER HOWARD,
JOHN WELCH,
D. W. HOWARD,
Committee.

CLASS 18.—JACKS AND MULES.

Pair aged mules—G. T. Saunders, Corunna, 1st premium........ $10 00

C. U. MOWRY,
A. B. KELLSI,
T. GOLDSMITH,
Committee.

SWEEPSTAKES PREMIUMS—DRAFT HORSES.

Span of draft horses to weigh not less than 1,400 pounds, to pull loaded sled or boat—Thomas Nester, Saginaw City, 1st premium........ $50 00
David Geddes, Saginaw City, 2d premium........ 25 00

D. HORTON,
D. WOLVERTON,
Committee.

DIVISION C.—SHEEP AND SWINE.

CLASS 19.—AMERICAN MERINOS.

Buck 2 years old or over—J. S. & A. A. Wood, Saline, 1st premium........ $25 00
J. S. & A. A. Wood, Saline, 2d premium........ 20 00
Alexander Lobban, Atlas, 3d premium........ 15 00
Buck one year old—J. S. & A. A. Wood, Saline, 1st premium........ 20 00
F. H. Dean, West Cornwall, Addison Co., Vt., 2d premium........ 15 00
J. S. & A. A. Wood, Saline, 3d premium........ 10 00
Three buck lambs—J. S. & A. A. Wood, Saline, 1st premium........ 12 00
W. E. Kennedy, Liberty, 2d premium........ 8 00
J. M. & B. C. Whittaker, Chelsea, 3d premium........ 6 00

Three ewes, 2 years old or over—J. S. & A. A. Wood, Saline, 1st premium	$25 00
J. S. & A. A. Wood, Saline, 2d premium	15 00
Bates & Dewey, Grand Blanc, 3d premium	10 00
Three ewes 1 year old—F. H. Dean, West Cornwall, Addison Co., Vt., 1st premium	20 00
J. S. &. A. A. Wood, Saline, 2d premium	15 00
J. M. & B. C. Whittaker, Chelsea, 3d premium	10 00
Three ewe lambs—J. S. & A. A. Wood, Saline, 1st premium	12 00
J. S. & A. A. Wood, Saline, 2d premium	8 00
Ball & Hardy, Hamburg, 3d premium	6 00

DANIEL SCHRAM,
JNO. G. THOMPSON,
JOHN McKAY,
Committee.

CLASS 20.—SOUTHDOWN AND OTHER MIDDLE-WOOLED SHEEP.

Buck 2 years old or over—Henry W. Lord, Pontiac, 1st premium	$20 00
Frank Tompkins, Girard, 2d premium	10 00
H. W. Lord, Pontiac, 3d premium	5 00
Yearling buck—W. Newton, Pontiac, 1st premium	10 00
H. W. Lord, Pontiac, 2d premium	5 00
H. W. Lord, Pontiac, 3d premium	3 00
Pen of buck lambs—W. Newton, Pontiac, 1st premium	10 00
H. W. Lord, Pontiac, 2d premium	6 00
W. Newton, Pontiac, 3d premium	3 00
Three ewes, two years old or over—W. Newton, Pontiac, 1st premium	20 00
H. W. Lord, Pontiac, 2d premium	10 00
H. W. Lord, Pontiac, 3d premium	5 00
Three ewes 1 year old—H. W. Lord, Pontiac, 1st premium	12 00
W. Newton, Pontiac, 2d premium	6 00
H. W. Lord, Pontiac, 3d premium	5 00
Three ewe lambs—H. W. Lord, Pontiac, 1st premium	10 00
W. Newton, Pontiac, 2d premium	4 00
H. W. Lord, Pontiac, 3d premium	3 00

JOHN H. GOTSHALL,
J. W. GOODENOUGH,
N. SMITH,
Committee.

CLASS 21.—COTSWOLD, LEICESTER, AND OTHER LONG-WOOLED SHEEP.

Buck two years old or over (Cotswold)—T. H. Arnold, North Branch, 1st premium	$20 00
(Cotswold) Wm. Newton, Pontiac, 2d premium	10 00
(Leicester) Solomon Schell, North Branch, 3d premium	5 00
Yearling buck—W. Newton, Pontiac, 1st premium	10 00
(Leicester) Amos F. Wood, Mason, 2d premium	5 00
(Leicester) Amos F. Wood, Mason, 3d premium	3 00
Pen of three buck lambs—W. Newton, Pontiac, 1st premium	10 00
Solomon Schell, North Branch, 2d premium	6 00
Amos F. Wood, Mason, 3d premium	3 00
Three ewes 3 years old or over—Wm. Newton, Pontiac, 1st premium	20 00
Amos F. Wood, Mason, 2d premium	10 00
Oscar Schoff, Tuscola, 3d premium	5 00
Three ewes 2 years old (Cotswold)—T. H. Arnell, North Branch, 1st premium	16 00
(Leicester) Amos F. Wood, Mason, 2d premium	8 00
W. Newton, Pontiac, 3d premium	4 00
Three ewes 1 year old (Leicester)—Amos F. Wood, Mason, 1st premium	12 00
(Leicester) Solomon Schell, North Branch, 2d premium	8 00
Three ewe lambs—Amos F. Wood, Mason, 1st premium	10 00
(Leicester) Solomon Schell, North Branch, 2d premium	5 00
Frank Willson, Jackson, 3d premium	3 00

Your committee are of the opinion that two year old breeding ewes are perfectly competent to compete with older ones in every respect, and think that the separating of the two ages is not only useless, but often leads to deception in making up pens;

and would earnestly recommend that aged ewes should be described in the premium lists as two years old or over.

H. G. HOLT,
JOHN MILLER,
WM. WHITFIELD,
Awarding Committee.

CLASS 22.—FAT SHEEP.

Pen of five fat sheep—D. P. Dewey, Grand Blanc, 1st premium	$15 00
Wm. Newton, Pontiac, 2d premium	10 00
Wm. Newton, Pontiac, 3d premium	6 00

JNO. H. GOTSHALL,
N. SMITH,
J. W. GOODENOUGH,
Committee.

CLASS 23.—SWINE.

Berkshire boar 2 years old or over—W. B. Way, Drayton Plains, 1st premium	$12 00
Oscar Schoff, Tuscola, 3d premium	4 00
Berkshire boar 1 year old—Daniel Tucker, Macomb, 1st premium	10 00
H. B. Jones, Dexter, 2d premium	6 00
Samuel Aplin, Jr., Flint, 3d premium	3 00
Berkshire sow 2 years or over—R. G. Hart, Lapeer, 1st premium	12 00
W. B. Way, Drayton Plains, 2d premium	8 00
Berkshire sow 1 year old—Samuel Aplin, Jr., Flint, 1st premium	10 00
Pen of Berkshire pigs, not less than four in number, nor over 10 months old—H. B. Jones, Dexter, 1st premium	10 00
W. B. Way, Drayton Plains, 2d premium	6 00
W. B. Way, Drayton Plains, 3d premium	3 00
Essex Boar 2 years old or over—Black Prince, E. T. Doney, Jackson, 1st premium	12 00
Samuel Aplin, Jr., Flint, 2d premium	8 00
Essex boar 1 year old—Ravenswood, E. T. Doney, Jackson, 1st premium	10 00
Young Champion, E. T. Doney, Jackson, 2d premium	6 00
Essex sow 2 years old or over—Amos F. Wood, Mason, 1st premium	12 00
Black Rose, E. T. Doney, Jackson, 2d premium	8 00
Frank Willson, Jackson, 3d premium	4 00
Essex sow 1 year old—Amos F. Wood, Mason, 1st premium	10 00
Pen Essex pigs, not less than four in number, nor over 10 months old—Amos F. Wood, Mason, 1st premium	10 00
E. T. Doney, Jackson, 2d premium	6 00
E. T. Doney, Jackson, 3d premium	3 00
Suffolk boar 2 years old or over—R. G. Hart, Lapeer, 1st premium	12 00
Suffolk sow 2 years old or over—R. G. Hart, Lapeer, 1st premium	12 00
Suffolk sow 1 year old or over—H. B. Jones, Dexter, 2d premium	6 00
Pen Suffolk pigs, not less than four in number, nor over 10 months old—H. B. Jones, Dexter, 1st premium	10 00
R. G. Hart, Lapeer, 3d premium	3 00

R. B. CARUSS,
A. R. HOAG,
S. B. PORTER,
Committee.

DIVISION D—POULTRY.

CLASS 24.

Collection of poultry entered and owned by one exhibitor—Ambrose Purchase, Jay, 1st premium	$25 00
Trio light brahma chicks—H. H. Lanz, Adrian, 1st premium	2 00
Trio dark brahma fowls—Frank A. Fergason, East Saginaw, 1st premium	2 00
Ambrose Purchase, Jay, 2d premium	1 00
Trio dark brahma chicks—R. Howchin, Holly, 1st premium	2 00
Oscar Schoff, Tuscola, 2d premium	1 00
Trio buff cochin fowls—Ambrose Purchase, Jay, 1st premium	2 00
R. Howchin, Holly, 2d premium	1 00

Trio buff cochin chickens—Ambrose Purchase, Jay, 2d premium	$1 00
Trio partridge cochin fowls—Ambrose Purchase, Jay, 1st premium	2 00
Trio partridge cochin chicks—R. Howchin, Holly, 1st premium	2 00
Trio white cochin chicks—R. Howchin, Holly, 1st premium	2 00
Pair blue game fowls—Fred. Koeplinger, East Saginaw, 1st premium	2 00
Trio black Spanish fowls—Mrs. Richard Elliott, Lansing, 2d premium	1 00
Trio white Leghorn fowls—H. Vasold, East Saginaw, 1st premium	2 00
Trio white Leghorn chicks—D. W. Green, Saginaw City, 1st premium	2 00
Trio silver Polish fowls—H. Vasold, East Saginaw, 2d premium	1 00
Trio silver Polish chickens—Ambrose Purchase, Jay, 1st premium	2 00
Trio creve-cœur chickens—H. W. Booth, East Saginaw, 2d premium	1 00
Trio Houdans, fowls—Ambrose Purchase, Jay, 1st premium	2 00
Trio Houdans, chicks—H. W. Booth, East Saginaw, 2d premium	1 00
Trio silver spangled Hamburg fowls—W. B. Mershon, East Saginaw, 1st prem.	2 00
R. Howchin, Holly, 2d premium	1 00
Trio silver spangled Hamburg chicks—W. B. Mershon, East Saginaw, 1st prem.	2 00
W. B. Mershon, East Saginaw, 2d premium	1 00
Trio gold-laced Sebright bantam fowls—F. A. Fergason, East Saginaw, 1st premium	2 00
Trio gold-laced Sebright bantam chickens—Frank A. Fergason, East Saginaw, 1st premium	2 00
Frank A. Fergason, East Saginaw, 2d preminm	1 00
Trio black African bantam fowls—R. Howchin, Holly, 1st premium	2 00
Pair bronze turkey fowls—Amos F. Wood, Mason, 1st premium	2 00
Pair peafowls—Ambrose Purchase, Jay, 1st premium	2 00
Pair Bremen geese—Ambrose Purchase, Jay, 1st premium	2 00
Pair Rouen ducks—Philip Garvey, East Saginaw, 1st premium	2 00
Pair Cayuga ducks—Amos F. Wood, Mason, 1st premium	2 00
Pair topknot ducks—Philip Garvey, East Saginaw, 2d premium	1 00
Pair Muscovy ducks—Philip Garvey, East Saginaw, 1st preminm	2 00
Best collection of pigeons entered and owned by one exhibitor—Benny Tuthill, East Saginaw, 1st premium	5 00
One pair red-pied pouters—John Behler, East Saginaw, 1st premium	1 00
One pair pouters, any color—Benny Tuthill, East Saginaw, 1st premium	1 00
One pair red-black carrier—John Behler, East Saginaw, 1st premium	1 00
One pair white fantails—John Behler, East Saginaw, 1st premium	1 00
One pair blue fantails—Benny Tuthill, East Saginaw, 1st premium	1 00
One pair jacobins—Benny Tuthill, East Saginaw, 1st premium	1 00
One pair turbits—H. Vasold, East Saginaw, 1st premium	1 00
One pair nuns—J. Behler, East Saginaw, 1st premium	1 00
One pair priests—J. Behler, East Saginaw, 1st premium	1 00
Best collection of singing birds entered and owned by one exhibitor—Fritz Uppendahl, East Saginaw, 1st premium	5 00
Pair Belgian canaries (song birds), C. Biersle, East Saginaw, 1st premium	2 00
One pair German canaries—Fritz Uppendahl, East Saginaw, 1st premium	2 00
Trio white African bantam fowls—Fred Koeplinger, East Saginaw, 1st premium	Discretionary
Trio black leghorn chicks—R. Howchin, Holly, 1st premium	Discretionary
Trio black cochin fowls—R. Howchin, Holly, 1st premium	Discretionary
Trio partridge cochin fowls—R. Howchin, Holly, 1st premium	Discretionary
One pair bronze geese—Ambrose Purchase, Jay, 1st premium	Discretionary
One pair moreheads—Benny Tuthill, East Saginaw, 1st premium	Discretionary
Common rabbit (buck)—Benny Tuthill, East Saginaw, special prem.	Discretionary
Common rabbit (doe)—Benny Tuthill, East Saginaw, special premium	Discretionary
Trio rabbits—Benny Tuthill, East Saginaw, special premium	Discretionary
One pair Chinese geese—David Geddes, Saginaw City, 1st premium	Discretionary
One pair white Hamburg fowls—F. McMann, Saginaw City, 1st prem.	Discretionary
One pair bronze turkeys, light colored—W. H. Booth, East Saginaw	Discretionary
One pair bronze turkeys, dark colored—W. H. Booth, East Saginaw	Discretionary

DIVISION E—FARM AND GARDEN PRODUCE AND MANUFACTURED PRODUCTS.

CLASS 25.—GRAIN AND SEEDS.

Bushel red winter wheat, yield not less than 20 bushels per acre—W. A. Rowe, Mason, 1st premium	$10 00
Bushel white winter wheat, yield not less than 20 bushels per acre—W. F. Near, Bath, 1st premium	10 00
Bushel white winter wheat, yield not less than 20 bushels per acre—Pratt Crissy, Alma, 2d premium	5 00
Bushel spring wheat—D. L. C. Eaton, Saginaw City, 1st premium	5 00
Jessie Hoyt, East Saginaw, 2d premium	3 00
Bushel rye—D. Woodman, Paw Paw, 1st premium	3 00
Bushel four-rowed barley, D. Woodman, Paw Paw, 1st premium	10 00
Bushel white oats, D. Woodman, Paw Paw, 1st premium	6 00
Ambrose Purchase, Jay, 2d premium	4 00
Bushel dent corn in the ear—D. Woodman, Paw Paw, 1st premium	6 00
Bushel flint corn, in the ear—Benj. McLellan, Saginaw City, 1st premium	6 00
D. Woodman, Paw Paw, 2d premium	4 00
Bushel smutty yellow corn—H. B. Chapman, Reading, 1st premium	6 00
Bushel red-nose corn—Wm. Hall, Yew, 2d premium	4 00
Bushel peas—T. H. Arnell, North Branch, 1st premium	6 00
Bushel white beans—Wm. Slafter, Tuscola, 1st premium	6 00
R. C. Clark, Jay, 2d premium	4 00
Bushel buckwheat—R. C. Clark, Jay, 1st premium	4 00
Best exhibition of a general assortment of seeds for field crops, greatest variety and quality of seeds to be taken into consideration—D. Woodman, Paw Paw, 1st premium ... Diploma and	20 00
Best display of a collection of the several kinds of grain in heads, arranged and named—D. Woodman, Paw Paw, 1st premium ... Diploma and	5 00
Bushel spring barley—D. L. C. Eaton, Saginaw City	Discretionary

C. A. CARPENTER,
C. H. MORSE,
Committee.

CLASS 26.—ROOTS AND VEGETABLES.

Best and greatest variety of roots for feeding stock—E. H. Wurtz, East Saginaw, 1st premium	$12 00
David Geddes, Saginaw City, 2d premium	8 00
Theo. Rottman, East Saginaw, 3d premium	4 00
Best and greatest variety of roots from any one garden—E. H. Wurtz, East Saginaw, 1st premium	12 00
David Geddes, Saginaw City, 2d premium	8 00
Theo. Rottman, East Saginaw, 3d premium	4 00
Three kinds of early potatoes, peck or more of each kind—David Geddes, Saginaw City, 1st premium	3 00
H. R. Haskell, Monroe, 2d premium	2 00
Three varieties of late potatoes, peck or more of each kind—David Geddes, Saginaw City, 1st premium	3 00
E. H. Wurtz, East Saginaw, 2d premium	2 00
Sample peck or more Early Rose potatoes—Ernest Herpel, Taymouth, 1st premium	Discretionary
D. W. Richards, Flint, 2d premium	Discretionary
Sample peck or more Early Vermont potatoes—John H. Bairus, Vassar, 1st premium	Discretionary
John Raaymaker, Bridgeport, 2d premium	$2 00
Sample peck or more white peachblow potatoes—H. B. Chapman, Reading, 1st premium	3 00
John Raaymaker, Bridgeport, 2d premium	2 00
Sample peck or more late potatoes—Browning's Beauty, E. H. Wurtz, East Saginaw, 1st premium	Discretionary
Peerless, Asahel Simons, Cass Bridge, 2d premium	$2 00
Dozen or more blood beets—G. P. Butler, East Saginaw, 1st premium	2 00
Dozen or more turnip beets—Theo. Rottman, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00

Dozen or more sugar beets—John Raaymaker, Bridgeport, 1st premium	$2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Dozen or more white beets—G. P. Butler, East Saginaw, 1st premium	2 00
Dozen or more beets for table use—E. H. Wurtz, East Saginaw, 1st premium	2 00
Theo. Rottmann, East Saginaw, 2d premium	1 00
Collection of 5 or more kinds of beets, 10 of a kind—David Geddes, Saginaw City, 1st premium	3 00
E. H. Wurtz, East Saginaw, 2d premium	2 00
Dozen or more mangel wurtzel—George W. Hardy, Carrollton, 1st premium	2 00
Dozen or more orange carrots—Geo. W. Hardy, Carrollton, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Dozen or more white carrots, Belgian—John Raaymaker, Bridgeport, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Dozen or more yellow carrots—E. H. Wurtz, East Saginaw, 1st premium	2 00
St. James yellow—David Geddes, Saginaw City, 2d premium	1 00
Collection 4 or more kinds carrots, 10 of a kind—David Geddes, Saginaw City, 1st premium	3 00
E. H. Wurtz, East Saginaw, 2d premium	2 00
Dozen or more flat turnips—David Geddes, Saginaw City, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Dozen or more Swede turnips—David Geddes, Saginaw City, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Dozen any other variety of turnips—Cow Horn, David Geddes, Saginaw City, 1st premium	2 00
Aberdeen, E. H. Wurtz, East Saginaw, 2d premium	1 00
Collection 4 or more kinds turnips, 10 of a kind—E. H. Wurtz, East Saginaw, 1st premium	3 00
David Geddes, Saginaw City, 2d premium	2 00
Dozen or more parsnips—long smooth, John Raaymaker, Bridgeport, 1st premium	2 00
Geo. W. Hardy, Carrollton, 2d premium	1 00
Dozen or more salsify—Geo. P. Butler, East Saginaw, 1st premium	2 00
John Raaymaker, Bridgeport, 2d premium	1 00
Dozen or more winter radishes—black Spanish, E. H. Wurtz, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Dozen or more summer radishes—E. H. Wurtz, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Collection 3 or more kinds of radishes, at least 10 of a kind—E. H. Wurtz, East Saginaw, 1st premium	3 00
David Geddes, Saginaw City, 2d premium	2 00
Greatest variety culinary vegetables grown by one exhibitor—E. H. Wurtz, East Saginaw, 1st premium	5 00
David Geddes, Saginaw City, 2d premium	3 00
Four heads drumhead cabbage—F. McMann, Saginaw City, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Four heads cone-head cabbage—John Shepherd, Saginaw City, 1st premium	2 00
Joseph Hitchcock, Buena Vista, 2d premium	1 00
Four heads savoy or curled cabbage—Joseph Hitchcock, Buena Vista, 1st premium	2 00
Theo. Rottman, East Saginaw, 2d premium	1 00
Four heads red cabbage—E. H. Wurtz, East Saginaw, 1st premium	2 00
Theo. Rottman, East Saginaw, 2d	1 00
Collection of 5 or more kinds cabbage, 4 or more heads of a kind—Joseph Hitchcock, Buena Vista, 1st premium	3 00
John Raaymaker, Bridgeport, 2d premium	2 00
Four heads cauliflower—John Fischer, Saginaw City, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Six heads lettuce—David Geddes, Saginaw City, 1st premium	2 00
Theo. Rottman, East Saginaw, 2d premium	1 00
Six bunches kale—E. H. Wurz, East Saginaw, 1st premium	2 00
J. Dieckmann, East Saginaw, 2d premium	1 00
Dozen stems celery, bleached—Theo. Rottmann, East Saginaw, 1st premium	2 00
John G. Owen, East Saginaw, 2d premium	1 00

Dozen stems rhubarb—Norman L. Miller, Saginaw City, 1st premium	$2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Six vegetable eggs—E. H. Wurtz, East Saginaw, 1st premium	2 00
Dozen peppers—J. Dieckmann, East Saginaw, 1st premium	2 00
Dozen peppers, sweet Spanish—John Raaymaker, Bridgeport, 2d premium	1 00
Three varieties tomatoes, one dozen of each kind, Geo. Kator, Northville, 1st premium	3 00
E. H. Wurtz, East Saginaw, 2d premium	2 00
Peck of any variety tomatoes—J. Dieckmann, East Saginaw, 1st premium	3 00
E. H. Wurtz, East Saginaw, 2d premium	2 00
Peck white onions—E. H. Wurtz, East Saginaw, 1st premium	3 00
Globe—John Raaymaker, Bridgeport, 2d premium	2 00
Peck red onions, Wethersfield—Wm. Hall, Yew, 1st premium	3 00
Thomas Nestor, Saginaw City, 2d premium	2 00
Peck yellow onions—E. H. Wurtz, East Saginaw, 1st premium	3 00
Joseph Hitchcock, Buena Vista, 2d premium	2 00
Collection of five or more kinds of onions, not less than one-half peck of a kind—E. H. Wurtz, East Saginaw, 1st premium	3 00
Geo. W. Hardy, Carrollton, 2d premium	2 00
Five summer squashes—David Geddes, Saginaw City, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Five marrow squashes—David Geddes, Saginaw City, 1st premium	2 00
Five Hubbard squashes—F. McMann, Saginaw City, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Single squash—W. A. Crane. Saginaw City, 1st premium	2 00
Geo. W. Hardy, Carrollton, 2d premium	1 00
Collection of four or more kinds of squashes, at least three of a kind—E. H. Wurtz, East Saginaw, 1st premium	3 00
David Geddes, Saginaw City, 2d premium	2 00
Two sweet pumpkins—John Raaymaker, Bridgeport, 1st premium	2 00
Two field pumpkins—John Raaymaker, Bridgeport, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Three watermelons—E. H. Wurtz, East Saginaw, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
Three muskmelons—E. H. Wurtz, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Three nutmeg melons—E. H. Wurtz, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Three citrons—Theo. Rottmann, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Collection of three or more kinds of melons, three or more of a kind—E. H. Wurtz, East Saginaw, 1st premium	3 00
Five cucumbers—F. & C. Reitter, East Saginaw, 1st premium	2 00
E. H. Wurtz, East Saginaw, 2d premium	1 00
One-half peck garden peas, blue imperial, E. H. Wurtz, East Saginaw, 1st premium	2 00
Bishop's long pod, E. H. Wurtz, East Saginaw, 2d premium	1 00
One-half peck Lima beans—E. H. Wurtz, East Saginaw, 1st premium	2 00
Peck bush beans—Geo. W. Hardy, Carrollton, 1st premium	2 00
Julius K. Rose, East Saginaw, 2d premium	1 00
One-half peck wax beans—E. H. Wurtz, East Saginaw, 1st premium	2 00
Collection of three or more kinds garden beans—E. H. Wurtz, East Saginaw, 1st premium	3 00
Geo. W. Hardy, Carrollton, 2d premium	2 00
Dozen ears early sweet corn, Crosby's Early, E. H. Wurtz, East Saginaw, 1st premium	2 00
Dozen ears late sweet corn—Jos. Hitchcock, Buena Vista, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Dozen ears pop corn—E. H. Wurtz, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Six heads sunflower—Asahel Simmons, Cass Bridge, Saginaw, 1st premium	2 00
Six heads sunflower—H. B. Chapman, Reading, 2d premium	1 00
Six stems Swiss chard—E. H. Wurtz, East Saginaw, 1st premium	2 00
David Geddes, Saginaw City, 2d premium	1 00
Six stems parsley—Joseph Hitchcock, Buena Vista, 1st premium	2 00
J. Dieckmann, East Saginaw, 2d premium	1 00

Six stems pot herbs—basil, E. H. Wurtz, East Saginaw, 1st premium	$2 00
Collection of four or more kinds sweet or pot herbs—J. Dieckmann, East Saginaw, 1st premium	3 00
E. H. Wurtz, East Saginaw, 2d premium	2 00
Six stems kohl rabi—Julius K. Rose, 1st premium	2 00
Theo. Rottmann, East Saginaw, 2d premium	1 00
Sample snake cucumbers—E. H. Wurtz, East Saginaw	Discretionary diploma
Two stalks okra or gumbo, E. H. Wurtz, East Saginaw	Discretionary diploma

Your committee, to whom was assigned the duty of awarding the premiums in Division E, Class 26, would commend in the highest terms the unusually fine display of the products of the farms and gardens of Michigan. In years past it has been a cause of deep regret that the exhibition in this important department has not better comported with the character of our State in the line of agricultural products; this year's exhibition is fully up to the standard, both in variety and quality of the specimens on exhibition. We include in this notice a summary of articles exhibited by the State College Farm, which were not in competition, but shown to the people of Michigan as evidence of what their sons at the Agricultural College are taught to produce. In variety, covering the entire list of farm products of this climate; in quality, not surpassed; and in accuracy of nomenclature—which made the exhibition a school in itself to all practical agriculturists and gardeners—this exhibition has done more to enlighten the public mind to the superior excellence of the practical education taught at the Agricultural College than all the finely written eulogiums ever published.

Of this College exhibition, the horticultural department occupied a large space on the east side of Agricultural Hall. This exhibition was not intended as a display of large products, but rather as a collection of varieties for comparison and instruction. In the background were arranged over thirty species of the more prominent grasses and forage plants; of the former those of most interest and attracting special attention were the orchard grass, fowl meadow grass, blue joint, couch grass, and several fescues; of the latter, five kinds of clover, lucerne, vetches, etc.

One shelf was devoted entirely to pumpkins, gourds and squashes, of which there were twenty-five sorts. Each sort was represented by as nearly a typical specimen as possible; some of the gourds had peculiarly delicate forms, while others were more unique than beautiful.

The second shelf was occupied by seventeen varieties of beets, including the blood, turnip, and mangel-wurtzel tribes.

The remainder of the collection of vegetables was arranged in rectangular boxes, each containing eight compartments. These were set up at an angle so that the contents could be easily viewed, and the different sections compared. This array of boxes contained ten varieties of carrots, four of parsnips, six of peppers, twenty of cucumbers, twelve of sweet herbs; also a plant containing the fruit of the vegetable snail. Perhaps the most attractive feature of the whole display of vegetables was the collection of 240 sorts of potatoes. We are informed that these varieties have all been planted in separate plats, and the product of each section weighed for purposes of comparison, so as to arrive at some definite opinion as to their comparative value and productiveness. We observed among others several foreign sorts as well as those more prominently before the public—Campbell's Late Rose, Brownell's Beauty, Peerless, Early Vermont, etc.

A striking feature of this display was a collection of all the more common weeds, arranged in pots and labeled with their proper names. These are being continually sent to our botanists and agricultural editors for names, and here they were placed where thousands of people could associate the names and plants together.

The fruit of the snake cucumber was coiled about one of the braces of the building, and attracted much attention.

The greatest curiosity of the college exhibition was a dwarf banana, transferred from the tropical room in the greenhouse. The plant was seventeen months old, nine feet in height, and in full fruit, and bore leaves the blades of which were five feet in width, by two feet four inches in breadth.

PETER DOW,
LYSANDER WOODWORTH,
JOHN W. NICHOLSON,
Committee.

CLASS 27.—FLOUR, MEAL, AND FEED.

Barrel of flour of white wheat—Mayflower, Mayflower Mills, East Saginaw, 1st premium	$5 00
Excelsior, Mayflower Mills, East Saginaw, 2d premium	3 00

Barrel flour of spring wheat—Superior, Mayflower Mills, East Saginaw, 1st premium	$3 00
Sample bolted meal—Riker Bros., Tuscola, 1st premium	2 00

C. A. CARPENTER,
C. H. MORSE,
Committee.

CLASS 28.—BUTTER AND CHEESE.

Display of cheese by any household, etc.—G. E. Hurd, West Haven, 1st prem.	$15 00
John B. Lapham, Farmington, 2d premium	10 00
H. B. Chapman, Reading, 3d premium	5 00
Display of cheese from any factory—A. B. Smith, Farmington, 1st premium, Silver medal and	35 00
W. J. Johnson, Reading, 2d premium	25 00
D. W. Richards, Flint, 3d premium	15 00
Twenty-five pounds domestic butter—Daniel F. Vickery, Charlotte, 1st prem.	25 00
Mrs. Harvey Spring, Kensington, 2d premium	20 00
Mrs. S. Greenley, Flint, 3d premium	15 00
Sample sage cheese—Mrs. James Bottom, East Saginaw, 2d premium	Discretionary

ELIJAH ZIMMERMAN,
E. H. WURTZ,
MRS. A. W. WRIGHT.
Committee.

CLASS 29.—SUGAR, HONEY, AND BEE HIVES.

Gallon maple syrup—L. P. Andrews, Flint, 1st premium	$3 00
Ten pounds maple sugar—Mrs. Wm. Johnstone, Flint, 1st premium	5 00
Specimen of honey in boxes—John Carr, East Saginaw, 1st premium	3 00
Dr. L. C. Whitney, East Saginaw, 2d premium	2 00
American bee-hive—Miles N. Rouse, East Saginaw, 1st premium, Diploma and	5 00
Bee-hive and method of securing honey—Dr. L. C. Whitney, East Saginaw, 2d premium	Discretionary
Honey extractor—Dr. L. C. Whitney, East Saginaw, 1st premium	Discretionary

Mr. Byron Walker shows some fine samples of honey in boxes which are not regularly entered. In the opinion of the judges his samples are worthy of a first premium.

In the opinion of the committee the honey extractor exhibited by the Agricultural College is a better size, and for practical use fully equal or superior to the extractor of Dr. Whitney. Other articles connected with bee-keeping were on exhibition by the Agricultural College, which the committee consider eminently worthy of mention: A queen cage, a bee-feeder, a honey knife, a quilt for bee-hives, a bee vail, and Quinby's bee smoker; also the Gallup frame. These articles are of the most approved pattern, and we feel that the thanks of the Society are due to Prof. Cook for placing these modern conveniences where they can be seen by those interested in bee matters. There were also on exhibition in the same connection specimens of Long's comb foundation, the invention of which is a great stride in the progress of bee culture.

C. A. CARPENTER,
C. H. MORSE,
Committee.

CLASS 30.—BREAD AND PICKLES.

Machine made bread—John G. Wolfarth, East Saginaw, 1st premium	Diploma
Three loaves bakers' bread—John G. Wolfarth, East Saginaw, 1st premium	$3 00
Three loaves milk or salt rising bread—Mrs. Edward Thompson, East Saginaw, 1st premium	3 00
Mrs. Ransom Stage, Pontiac, 2d premium	2 00
Three loaves of yeast bread—Mrs. Alfred W. Newton, East Saginaw, 1st premium	3 00
F. T. Butler, Pontiac, 2d premium	2 00
Soda rising bread—Ransom Stage, Pontiac, 1st premium	3 00
Corn bread—H. B. Chapman, Reading, 1st premium	3 00
John G. Wolfarth, East Saginaw, 2d premium	2 00
Three loaves brown bread—Mrs. David Geddes, Saginaw City, 1st premium	3 00
Three loaves rye and Indian bread—H. B. Chapman, Reading, 2d premium	2 00
Sample flour bread made by girl 16 or under—Josephine Thompson, East Saginaw, 1st premium	3 00

Sample brown bread made by girl 16 or under—Josephine Thompson, East Saginaw, 1st premium $3 00
Display of varieties of crackers made by one person—John G. Wolfarth, East Saginaw, 1st premium .... Diploma
Display of specimens of pickled vegetables—Mrs. G. P. Butler, East Saginaw, 1st premium $5 00
Fred W. Guild, aged 11 years, East Saginaw, 2d premium 3 00
Exhibition of yeast—Waterloo Yeast Company, Detroit, 1st premium .... Discretionary diploma
Cucumber pickles—Mrs. G. P. Butler, E. Saginaw, 1st premium .. Discretionary diploma
Sample fruit cake—John Gamble, East Saginaw, 1st premium .. Discretionary diploma

MRS. M. N. HAMLIN,
MRS. R. WELTS.
MRS. D. F. ROSE,
Committee.

CLASS 31—SOAPS, TOILET ARTICLES, SAMPLES OF PREPARED GROCERIES, ETC.

Display of toilet soaps—Casper Schulte, Detroit, 1st premium .... Diploma
Display of washing soaps—Casper Schulte, Detroit, 1st premium .... Diploma
Sample chewing tobacco, "Gilt Edge"—Geo. A. Soyer & Co., East Saginaw, 1st premium .... Diploma
Sample smoking tobacco, "Vanity Fair"—Geo. A. Soyer & Co., East Saginaw, 1st premium .... Discretionary diploma
Samples American Corundum—Wm. Cavenaugh, agent, Detroit, 1st premium Discretionary premium
Samples dentrifice or tooth powder—Mrs. L. E. Polhemus, Ann Arbor, 1st premium .... Discretionary diploma

Samples of chewing and smoking tobacco exhibited by Geo. A. Soyer & Co. were very choice, and the committee awarded them a diploma, and wish they had it in their power to do better for those gentlemen.

W. A. NORTON,
BROOK BRITTAIN,
Committee.

CLASS 32—MISCELLANEOUS.

Sample fertilizer—Casper Schulte, Detroit, 1st premium ...... Discretionary diploma
Sample Cervalet sausage, made in 1874—Hermann Schalle, Detroit, 1st premium Discretionary diploma
Sample Salami sausage, made in 1874—Hermann Schalle, Detroit, 1st premium Discretionary diploma
Sample tongue sausage, made in 1874—Hermann Schalle, Detroit, 1st premium
Sample fresh-made ham—Hermann Schalle, Detroit, 1st premium .. Discretionary dip.
Centennial polish—G. Hengstebeck, Detroit, 1st premium ..... Discretionary diploma

MRS. D. F. ROSE,
MRS. M. N. HAMLIN,
MRS. R. WELTS,
Committee.

DIVISION F.

CLASS 33.—PLOWS.

Plow for turning sod land or green sward—Ann Arbor Agricultural Company, Ann Arbor, 1st premium .... Diploma and $10 00
Plow for turning under stubble—Kimball & Austin Manufacturing Co., Kalamazoo, 1st premium 5 00
Plow for general use, made in Michigan—Lawrence & Chapin, Kalamazoo, 1st premium .... Diploma and 10 00
Heavy plow for new land—Kimball & Austin Manufucturing Co., Kalamazoo, 1st premium .... Diploma and 5 00
Attachment for any plow for covering grass or long manure—Gale Manufacturing Co., Albion, 1st premium 5 00
Self-cleaning plow coulter—Kimball & Austin Manufacturing Co., Kalamazoo, 1st premium .... Diploma
Gang plow—Gale Manufacturing Co., Albion, 1st premium .... Diploma

Display of plows, exhibited by manufacturer—Gale Manufacturing Co., Albion, 1st premium $75 00
Kimball & Austin Manufacturing Co., Kalamazoo, 2d premium 50 00
Lawrence & Chapin, Kalamazoo, 3d premium 25 00

To the Michigan State Agricultural Society:

Your committee, appointed to examine plows on exhibition, would respectfully report, after having made a careful examination, that they have awarded the premiums as per schedule, as classed, and would here state that the exhibition was a magnificent display, and a credit to the State of Michigan and her artisans.

S. H. BUSHNELL,
THOMAS McCLUMPHA,
B. MOSHER,
Committee.

CLASS 34.—TILLAGE IMPLEMENTS.

Harrow for general use—Lawrence & Chapin, Kalamazoo, 1st premium Diploma and $5 00
Wooden harrow—Kimball & Austin Manufacturing Co., Kalamazoo, 1st premium 3 00
Machine for hoeing and weeding drills in garden—D. M. Ferry & Co., Detroit, 1st premium .... Diploma
One-horse cultivator—Morley Bros., East Saginaw, 1st premium .... Dip. and $3 00
Field roller, Manly's patent—J. A. Anderson, Otsego, 1st premium .... Dip. and 5 00
G. T. Van Arsdale, Chicago, Ill., 2d premium .... Discretionary
Display of cultivators (10)—Robbins, Dwight & Burrall, Hastings, 1st prem $75 00
Ann Arbor Agricultural Co., Ann Arbor, 2d premium 50 00
P. P. Mast & Co., Springfield, Ohio, 3d premium 25 00
Abbott, Brewer & Co.'s four-shoveled one-horse cultivator, entitled to credit.

Your committee have examined the articles in this class and consider them superior in many respects, and recommend them to your consideration.

A. B. GULLEY,
L. DEAN,
GEORGE KATOR,
Committee.

CLASS 35.—SEED DRILLS, SOWERS, PLANTERS, ETC.

Two-horse seed drills—P. P. Mast & Co., Springfield, O., 1st premium $40 00
Warner & Tuttle, Dowagiac, 2d premium 25 00
Two-horse seeder for grain—P. P. Mast & Co., Springfield, O., 2d premium 20 00
Ashes and plaster sower—Geo. H. Fowler & Co., Detroit, 1st premium .... Diploma
Corn planter and horse power—C. F. Rand, Grand Haven, 1st premium .... Diploma

CLASS 36.—HAYING AND HARVESTING IMPLEMENTS.

Machine for mowing lawns by hand—D. M. Ferry & Co., Detroit, 1st premium Diploma
Horse rake—Gale Manufacturing Company, Albion, 1st premium $20 00
Empire State, S. H. Bushnell, Fairport, N. Y., 2d premium 10 00
B. C. Taylor, Dayton, Ohio, 3d premium 10 00
Harpooon horse pitchfork—Morley Bros., East Saginaw, 1st premium .... Silver medal
Contrivance for husking corn—John Ure, Saginaw City, 1st premium .... Diploma
Potato digger—D. H. Jerome & Co., Saginaw City, 1st premium .... Diploma
Hay and straw press, horizontal—Roberts & Bittorf, Wyandotte, 1st premium Silver medal

JOHN SPRAGUE,
VICTOR B. ROTHERS,
SAMUEL WILSON,
Committee.

CLASS 37.—APPARATUS AND MACHINES CONNECTED WITH THE CLEANING AND PREPARATION OF CROPS FOR MARKET AND FOR THE FEEDING OF STOCK.

Horse power for general use—LeRoy Marley, Jackson, 1st premium $30 00
C. W. Browne, Battle Creek, 2d premium 15 00
Straw and stalk cutter, hand power—C. F. Rand, Grand Haven, 1st premium Diploma

Display of corn shellers—Geo. H. Fowler & Co., Detroit, 1st premium........ $15 00
Ann Arbor Agricultural Co., Ann Arbor, 2d premium........................ 10 00
Contrivance for steaming food for stock—P. P. Mast & Co., Springfield, Ohio, 1st premium.. Medal
Portable cider mill—Abbott, Brow & Co., Cleveland, Ohio, 1st premium.....Diploma
Atmospheric—John Clark, Pontiac, discretionary..........................Diploma
Portable steam engine for agricultural purposes—P. P. Mast & Co., Springfield, Ohio, 1st premium.................................Medal and diploma
Merritt & Kellogg, Battle Creek, discretionary..........................Diploma
Portable grist mill—L. F. Browne, Augusta.............................. Medal
Display of feed cutters—Ann Arbor Agricultural Co., Ann Arbor, 1st premium. $25 00
Geo. H. Fowler & Co., Detroit, 2d premium.............................. 15 00

ABEL ANGEL,
W. F. BRADISH,
JACOB ARNOLD,
Committee.

CLASS 38.—MISCELLANEOUS FARM ARTICLES.

Drag sawing machine—W. D. King & Co., Pontiac, 1st premium............... $20 00
Circular sawing machines—W. D. King & Co., Pontiac, 1st premium.......... 20 00
Six axes—D. H. Jerome & Co., Saginaw City, 1st premium................... 2 00
Hand pump for wells—John Bean & Son, Hudson, 1st premium...............Diploma
Cistern pump—John Bean & Son, Hudson, 1st premium......................Diploma
Farm entrance gate—Joseph E. Strong, Newton Brook, York Co., Ont., 1st premium..Diploma
Farm fence—Merton's portable, John Morton, Thornville, 1st premium......Diploma
Display metal-lined wood pumps—E. L. Crosby, Plymouth, discretionary....Diploma
Land leveler—Freedom Monroe, Romeo, discretionary.......................Diploma
Stump-puller—Giant Extractor, D. Bennett, Saginaw City, 1st premium...... $20 00
Windmill and pump—Marshall Wind Engine and Pump Co., Marshall, 1st premium... Medal

C. F. PRIEST,
J. H. ARMSTRONG,
C. ELIOT,
Committee.

CLASS 39.—DAIRY AND HOUSEHOLD ARTICLES.

Dozen brooms—Excelsior patent, J. D. Brooks, Flint, 1st premium. ....Diploma
Wisp—J. D. Brooks, Flint, discretionary.................................Diploma
Washing machine—Calkins', Michigan Manufacturing Co., Kalamazoo, 1st premium..Diploma
Clothes-wringing machine—D. H. Jerome & Co., Saginaw City, 1st premium.Diploma
Clothes-horse—Wrights, Michigan Manufacturing Co., Kalamazoo, 1st premium...Diploma
Fancy wooden toy tub—I. W. Gray, Otisville, 1st premium.............Discretionary
Fancy wooden milk pail—I. W. Gray, Otisville, 1st premium...........Discretionary
Cider barrel—I. W. Gray, Otisville, 1st premium.....................Discretionary
Wash tub—I. W. Gray, Otisville, 1st premium.........................Discretionary

THOMAS A. HAWLEY,
LESTER COOK,
Committee.

DIVISION G—VEHICLES.

CLASS 40.—WAGONS AND CARRIAGES.

Two-horse family carriage—Frank G. Wilkie, East Saginaw, 1st premium, Diploma and $10 00
Two-spring phaeton—W. S. Houghton, East Saginaw, 1st premium, Diploma and 5 00
Three-spring phaeton, open—H. M. Curtiss, Ypsilanti, 1st premium, Diploma and 5 00
H. M. Curtiss, Ypsilanti, 2d premium...................................... 5 00
Top buggy—Brewster; Scovill, Lyman & &o., Coldwater, 1st premium, Diploma and 5 00
H. M. Curtiss, Ypsilanti, 2d premium...................................... 5 00

Buggy without top—H. M. Curtiss, Ypsilanti, 1st premium......Diploma and $5 00
Crook's patent, John Lovell, Tiffin, Ohio, 2d premium........................ 5 00
Trotting wagon, side spar—W. S. Houghton, East Saginaw, 1st premium, Diploma and 5 00
Trotting sulky—A. Bedford, Coldwater, 1st premium.............Diploma and 5 00
Scovill, Lyman & Co., Coldwater, 2d premium................................. 5 00
Farm wagon for all purposes—Austin, Tomlinson & Webster, Jackson, 1st premium.. 10 00
Austin, Tomlinson & Webster, Jackson, 2d premium............................ 5 00
Two-horse family sleigh—W. A. Patterson, Flint, 1st premium.................. 10 00
Single cutter—A. Randall, Flint, 1st premium..................................... 5 00
James H. Jerome, Saginaw City, 2d premium................................... 3 00
Single farm wagon—Austin, Tomlinson & Webster Manufacturing Co., Jackson, 1st premium.. 5 00
Dray or freight wagon—Johnson & Buckeridge, Port Huron, 1st premium..... 5 00
Sleigh for lumber purposes—H. S. Bartlett & Co., Midland City, 1st prem....Diploma
Truck for lumber purposes—Austin, Tomlinson & Webster Manufacturing Co., Jackson, 1st premium..Diploma
Pair bob. sleighs for general use—Wykoff, Clark & Immen, Howell, discretionary..Diploma

DR. G. FRED SELLECK,
D. S. HALSTEAD,
T. W. BRIGGS,
Committee.

DIVISION II—MACHINERY.

CLASS 41.—MACHINERY FOR WORKING ON IRON AND OTHER METALS.

Steam engine, to be shown in operation—Merritt & Kellogg, Battle Creek, 1st premium...Medal
Steam pump—Bearie's rotary, D. H. Jerome & Co., Saginaw City, 1st premium...Diploma
Smalley Bros. & Co., Bay City...Diploma
Saw gummer—D. H. Jerome & Co., Saginaw City, 1st premium..............Medal
Pony surface planer—James Jenks, Detroit, 1st premium.........................Medal
Surface planer—S. A. Wood's Machine Co., East Saginaw, 1st premium..........Medal
Moulding machine—S. A. Wood's Machine Co., East Saginaw, 1st premium...Diploma
Planer and matcher—S. A. Wood's Machine Co., East Saginaw, 1st premium....Medal
Paneling machine—John Warren, Flint, discretionary..............................Medal
Steam engine—Wickes Bros., East Saginaw, discretionary.........................Medal
Drive chain and conveyor—Evarts' patent chain, Garland & Emery, Bay City, Discretionary
Combined band and scroll sawing machine—James Jenks, Detroit......Discretionary
Pony band sawing machine—James Jenks, Detroit, 2d premium.........Discretionary
Shaper—James Jenks, Detroit...Discretionary
Fire extinguisher—Ætna, James Jenks, Detroit ....Discretionary
Barrel-hoop machine—Geo. C. Skidmore, Grand Rapids...................Discretionary
Circular saw guides—Wm. M. Ferry, Grand Haven..........................Discretionary
Hardy's patent car coupler, self-acting—Alex. Chapman, East Saginaw..Discretionary
Parallel shingle edger—James E. Austin, Ionia..............................Discretionary
Rotary siding machine—Lane Manufacturing Co., Montpelier, Vt..........Discretionary
Rotary bed and surface planer—Lane Manufacturing Co., Montpelier, Vt..Discretionary
Machine for making patent boot corks—R. D. Guilford, St. Charles.....Discretionary
Model of boot corks—R. D. Guilford, St. Charles ....Discretionary
Model of snow plow—Chas. Inman, Hope.....................................Discretionary
Chas. Inman's improved shingles—Chas. Inman, Hope.....................Discretionary
Samples gas pipe, well tubing and boiler tube—D. H. Jerome & Co., Saginaw City...Discretionary
Two saw arbors—D. H. Jerome, Saginaw City...............................Discretionary
Sample rubber-coated gas pipe—D. H. Jerome, Saginaw City...........Discretionary
Salt well working barrel—D. H. Jerome, Saginaw City.....................Discretionary
One case mill saws—D. H. Jerome, Saginaw City...........................Discretionary
One case brass goods—D. H. Jerome, Saginaw City........................Discretionary
One case emery wheels—D. H. Jerome & Co., Saginaw City.............Discretionary
Model of current water-wheel—W. W. Cleveland, Coldwater...............Discretionary

Model of saw mill—Edward P. Allis & Co., Milwaukee, Wis., discretionary...Diploma
Water injector—Wickes Bros., East Saginaw....Discretionary
Adjustable saw clamp—S. P. Babcock, Adrian....Discretionary
Hub boring machine—A. O. Abbott, Adrian....Discretionary
Door check model, Roberts' patent—C. B. Rogers, Champaign, Ill....Discretionary
Hand fire engine—John Bean & Son, Hudson....Discretionary

C. W. GRANT,
MOSES BROWN,
E. S. NEWTON,
Committee.

CLASS 42.—RAILROAD ROLLING STOCK.

Iron bridge (the same as across the Saginaw River, East Saginaw, C. S. & C. R. R.)—Wrought Iron Bridge Co., Canton, Ohio, discretionary premium......Medal

G. M. HINCKLEY,
DENNIS LANE,
Committee.

DIVISION I—MANUFACTURED GOODS.

CLASS 43.—HOME MADE.

Hearth rug—Mrs. James B. Twist, South Saginaw, 1st premium....	$3 00
Mrs. James B. Twist, South Saginaw, 2d premium....	2 00
Hearth rug or door mat—Mrs. B. Carr, East Saginaw..Worthy discretionary premium	
Ten yards rag carpet—Mrs. Austin Smith, Bay City, 1st premium....	$3 00
Miss Evelin Felt, Flushing, 2d premium....	2 00
Woolen coverlet—Mrs. Ransom Stage, Pontiac, 1st premium....	3 00
Mrs. A. B. Smith, Farmington, 2d premium....	2 00
Pair woolen stockings—Mrs. Wm. H. Beach, East Saginaw, 1st premium....	2 00
Mrs. A. B. Smith, Farmington, 2d premium....	1 00
Pair woolen mittens—Mrs. Ransom Stage, Pontiac, 1st premium....	2 00
Miss Birdie Rose, East Saginaw, 2d premium....	1 00
Two pounds stocking yarn—Mrs. Ransom Stage, Pontiac, 1st premium....	3 00
Mrs. Ransom Stage, Pontiac, 2d premium....	2 00
Pair cotton socks—A. B. Smith, Farmington, 1st premium....	2 00
Mrs. Richard Elliott, Lansing, 2d premium....	1 00
Knitted bed-spread—Mrs. Reuben Anderson, Flint, 1st premium....	4 00
Mrs. H. Budd, East Saginaw....	2 00
White bed-spread—Mrs. M. A. Lawrence, East Saginaw, 1st premium....	5 00
Mrs. J. D. Dates, St. Johns, 2d premium....	3 00
Ten yards tow cloth—A. B. Smith, Farmington, 1st premium....	3 00
Mrs. A. A. Parsons, Saginaw City, 2d premium....	2 00
Pair linen stockings—A. B. Smith, Farmington....Discretionary	

MRS. R. G. HART,
MRS. H. N. LATHROP,
MRS. C. W. GREENE,
Committee.

CLASS 44.—FACTORY MADE.

Display of goods from any woolen factory in Michigan—North & Selden, Vassar, 1st premium....	$25 00
Piece plain cassimere, 12 ounces or over per yard—North & Selden, Vassar, 1st premium....Diploma and	5 00
Display of flannels from any factory in Michigan—North & Selden, Vassar, 1st premium....	Medal
Display of cotton and silk goods—J. Bauman, Saginaw City, 1st premium Medal and	$5 00
Two Marseilles quilts—J. Bauman, Saginaw City, 1st premium....	Diploma
Display of cotton batting—J. Bauman, Saginaw City, 1st premium....	Diploma
Display imported piece goods—J. Seligman, East Saginaw, discretionary....	Diploma

MRS. R. G. HART,
MRS. C. W. GREENE,
MRS. H. N. LATHROP,
Committee.

CLASS 45.—ARTICLES OF DRESS.

Suit men's clothes, coat, pants, and vest—Jacob Seligman, East Saginaw, 1st premium .... Diploma and $5 00
Made overcoat—Jacob Seligman, East Saginaw, 1st premium 3 00
Frock coat—Jacob Seligman, East Saginaw, 1st premium 3 00
Made shirts, five in number—Jacob Seligman, East Saginaw, 1st premium 3 00
Display of soft hats—Jacob Seligman, East Saginaw, 1st premium .... Diploma
Display of pants—Jacob Seligman, East Saginaw .... Discretionary diploma
Lung protector, or under vest for gents and ladies—Mrs. Jane Culver, Adrian, Discretionary premium

MRS. R. G. HART,
MRS. C. W. GREENE,
MRS. H. N. LATHROP,
Committee.

CLASS 46.—ARTICLES OF LEATHER AND INDIA RUBBER WARE.

Lady's satchel—Jacob Seligman, East Saginaw, 1st premium $1 00
Pair gents' winter boots—William Ackerman, Flint 2 00
One double carriage harness—Warner & Gould, East Saginaw, 1st premium, Diploma and 5 00
Warner & Gould, East Saginaw, 2d premium 5 00
Single or buggy harness—Warner & Gould, East Saginaw, 1st premium, Diploma and 3 00
Farm wagon double harness—Warner & Gould, East Saginaw, 1st premium 2 00
Farm wagon single harness—Warner & Gould, East Saginaw, 1st premium 2 00
Cart harness—Warner & Gould, East Saginaw, 1st premium 2 00
Dozen calf skins—Charles Wilder, Saginaw City, 1st premium 1 00
Fancy buffalo robe (coon skin)—Miss D. H. Halsey, East Saginaw, 1st premium. 2 00
Chas. Wilder, Saginaw City .... Discretionary premium
Fancy blanket—Warner & Gould, East Saginaw, 1st premium $2 00
Lumber harness—Warner & Gould, East Saginaw .... Discretionary premium
Display of horse boots—Warner & Gould, East Saginaw .... Discretionary premium
Display of horse clothing—Warner & Gould, East Saginaw .... Discretionary premium
Display of bits and harness trimmings—Warner & Gould, East Saginaw Discretionary premium
Display of whips—Warner & Gould, East Saginaw, 1st premium $1 00
Display of two sides harness leather—Warner & Gould, East Saginaw, Discretionary premium
Display of harness and turf goods—Warner & Gould, East Saginaw, Discretionary premium
Display of gun-wipers, tumbler, jar, bottle, flute, revolver, pistol, lamp chimney, lamp, faucet, and pipe cleaner—Francis Scrigna, East Saginaw, recommend premium $1 00
Display of buck gloves and mittens—O. N. Hosmer, East Saginaw, Discretionary premium
Display of gent's kid gloves—O. N. Hosmer, East Saginaw .... Discretionary premium
Patent picket screen for raftsmen—Wm. Ackerman, Flint .... Discretionary premium
Hitching strap clasp—Alex. Cummings, East Saginaw .... Discretionary premium
Rein holders—Alex. Cummings, East Saginaw .... Discretionary premium

I. W. VAN FOSSEN,
D. WOODMAN,
ASA CROFOOT,
Committee.

CLASS 47.—ARTICLES OF FURNITURE.

Set parlor furniture, 7 pieces—Feige Bros., East Saginaw .... Diploma and $10 00
One easy chair—Feige Bros., 1st premium 3 00
One smoking or lounging chair—Feige Bros., 1st premium 3 00
Center table—Feige Bros., 1st premium 5 00
Pier mirror and base—Feige Bros., 1st premium 5 00
Set chamber furniture, not less than three pieces—Feige Bros., 1st premium Diploma and 10 00
Spring bed bottom—Comstock Bros., Adrian, 1st premium 3 00
Spring mattress—M. B. Heacock, Hillsdale .... Diploma

Sideboard—Feige Bros., East Saginaw, 1st premium........ $5 00
Book-case—Feige Bros., 1st premium........ 5 00
Parlor writing desk—Feige Bros., 1st premium........ 5 00
Office desk—Feige Bros., 1st premium........ 5 00
Michigan School Furniture Co., Northville, 2d premium........ 3 00
Hall tree or hat rack—Feige Bros., 1st premium........ 5 00
Display of furniture of all kinds—Feige Bros., 1st premium......Diploma and 10 00
School seat and desk—Michigan School and Furniture Co., Northville, 1st premium........Diploma
Assortment of school furniture—Michigan School Furniture Co., 1st premium. Medal
Billiard table—J. M. Bruswick & Balke, Chicago, Ill., 1st premium. Diploma and medal
Display of rustic wood-work—E. H. Wurtz, East Saginaw, 2d premium........ $3 00
Ottoman—Feige Bros., East Saginaw........Discretionary premium
Church seat—Michigan School Furniture Co., Northville, Recommend discretionary premium
Hall seat—Michigan School Furniture Co., Northville, Recommend discretionary premium
Display ladies' toilet ware—C. G. Pease, Concord, Ohio, Recommend discretionary premium

MRS. R. G. HART,
MRS. H. N. LATHROP,
C. W. GREENE,
D. WOODMAN,
Committee.

CLASS 48.—STOVES, IRON WORK, AND ORNAMENTAL CONCRETE WORK.

Display of stoves—Morley Bros., East Saginaw, 1st premium........ Medal
Cooking stove for wood—"Centennial," Morley Bros., 1st premium........ Medal
Cooking stove for coal—"Detroit Cook," Morley Bros., 1st premium........ Medal
Parlor or hall stove—"Forest Light," Morley Bros., 1st premium........ $5 00
Self-regulating stove for parlor—"Forest Home," Morley Bros., 1st premium.. 5 00
Office or depot stove—"Monumental," Morley Bros., 1st premium........ 5 00
Assortment of hollow ware—Morley Bros., 1st premium........Diploma
Parlor grate—"Classic Heater," Morley Bros., 1st premium........ $2 00
Apparatus for cooking range—"Ransom's Range," Morley Bros., 1st premium Diploma
Furnace for warming house, economy, etc.—F. J. Buck, Adrian, 1st premium Silver medal
Base burning coal stove—"Argand," Morley Bros., East Saginaw, 1st premium Diploma
Specimens of stucco—Geo. Low, East Saginaw........Discretionary premium
Reversible griddle—D. M. Allen, South Newburg, Ohio........Discretionary premium

I. W. VAN FOSSEN,
D. WOODMAN,
ASA CROFOOT,
Committee.

DIVISION K.—PAINTING, NEEDLE WORK, ETC., ETC.

CLASS 49.—PAINTING AND SCULPTURE.

Historical painting in oil by exhibitor—Miss Ella Brewer, East Saginaw, 1st premium........ $8 00
Composition landscape in oil—Ella W. Owen, East Saginaw, 1st premium..... 8 00
Mrs. W. S. Fish, Saginaw city, 2d premium........ 5 00
Landscape from nature in oil—Mrs. J. O. Peabody, Hanover, 1st premium..... 5 00
Mrs. W. S. Fish, Saginaw City, 2d premium........ 3 00
Marine scene in oil—Mrs. W. S. Fish, Saginaw City, 1st premium........ 5 00
F. A. Brewer, East Saginaw, 2d premium........ 3 00
Animal piece from life, in oil—Mrs. M. B. Morse, East Saginaw, 1st premium.. 5 00
Mrs. W. S. Fish, Saginaw City, 2d premium........ 3 00
Portrait from life, large size, in oil—J. M. Clark, Detroit, 1st premium........ 5 00
Mrs. J. O. Peabody, Hanover, 2d premium........ 3 00
Portrait from life, cabinet size, in oil—Mrs. J. O. Peabody, 1st premium...... 3 00
Fancy painting in oil, done by exhibitor—Miss Kate Hayden, East Saginaw, 1st premium........ 3 00

Fancy painting in water colors, done by exhibitor—flowers, Mrs. M. L. Driggs, East Saginaw, 1st premium	$3 00
Historical painting in oil, by any person,—Mrs. Geo. A. Lathrop, East Saginaw, 1st premium	5 00
Geo. Lockley, East Saginaw, 2d premium	3 00
Landscape painting, shown by any person—Geo. Lockley, East Saginaw, 1st premium	3 00
Mrs. M. B. Morse, East Saginaw, 2d premium	2 00
Marine painting, shown by any person—Joshua Tuthill, East Saginaw, 1st premium	3 00
Other paintings in oil shown by any person—G. Lockley, East Saginaw, 1st premium	3 00
Three water color paintings, shown by any person—Joshua Tuthill, East Saginaw, 1st premium	3 00
Three water color paintings, shown by exhibitor—Mittie Gates, East Saginaw, 2d premium	2 00
Collection of oil paintings, not less than five in number, by a person not a dealer—George Lockley, East Saginaw, 1st premium	8 00
Miss Kate Hayden, East Saginaw, 2d premium	5 00
Collection of water color paintings, not less than five in number, by a person not a dealer—George Lockley, East Saginaw, 1st premium	5 00
Joshua Tuthill, East Saginaw, 2d premium	3 00
Collection of oil paintings by any dealer or association—J. M. Clark, Detroit, 1st premium	10 00
Mrs. W. S. Fish, Saginaw City, 2d premium	5 00
Collection of water-color paintings by any dealer or association—J. M. Clark, Detroit, 1st premium	5 00
Pastel painting of face—W. L. Goodrich, East Saginaw, 1st premium	3 00
Joshua Tuthill, East Saginaw, 2d premium	2 00
Pastel painting of animals—D. W. Green, Saginaw City, 1st premium	3 00
Mrs. F. W. Sebring, Saginaw City, 2d premium	2 00
Crayon drawing of face, by a girl 14—Mrs. M. L. Driggs, East Saginaw, 1st premium	3 00
Mittie Gates, East Saginaw, 2d premium	2 00
Crayon drawing of animal (face)—Ella W. Owen, Saginaw City, 1st premium	3 00
Crayon drawing of landscape—Ella W. Owen, 1st premium	3 00
Collection of photographs by any person—Wm. L. Goodrich, East Saginaw, 1st premium ... Diploma and	3 00
Landscape photograph—Wm. L. Goodrich ... Recommended	3 00
Portrait photograph, oil colored—Miss Kate Hayden, East Saginaw, 1st premium	3 00
Wm. L. Goodrich, East Saginaw, 2d premium	2 00
Three cabinet photographs—Mrs. W. A. Armstrong, Saginaw City, 1st premium	3 00
W. L. Goodrich, East Saginaw, 2d premium	2 00
Single chromo lithograph—Mrs. W. A. Armstrong, Saginaw City, 1st premium	3 00
Single plain photograph—J. M. Clark, Detroit, 1st premium	3 00
Pencil drawing by person under 14 years—Miss Birdie Rose, East Saginaw, 1st premium	3 00
Mittie Gates, East Saginaw, 2d premium	2 00
Drawing of any animal on the grounds—Mrs. J. O. Peabody, Hanover, 1st premium	5 00
India ink drawing (Orphan's Prayer)—B. F. Seeley, East Saginaw, 1st premium	——
Specimen architectural drawing—J. Dieckmann, East Saginaw, 1st premium	3 00
Specimen machinery drawing—Mrs. E. C. Ripley, Saginaw City, 2d premium	2 00
Specimen crayon drawing—O. P. Barber, Saginaw City, 1st premium	3 00
Mrs. A. A. Parsons, Saginaw City, 2d premium	2 00
Specimen of penmanship by boy under fifteen years—W. E. Allington, East Saginaw, 1st premium	5 00
Sample etching on glass—D. V. Kern, Adrian, 1st premium	3 00
Single chromos—Wm. Smith, East Saginaw, 1st premium	3 00
Illustration chromo printing—Wm. Smith, 1st premium ... Diploma and	5 00
Set stereoscopic views—Mrs. L. W. Schellhouse, Ada, 1st premium recommended	3 00
W. L. Goodrich, East Saginaw, 2d premium	2 00

Penciling, head, by girl 14 years—Mrs. M. L. Driggs, East Saginaw, Discretionary premium
Specimen photographs on linen—W. L. Goodrich, East Saginaw, Discretionary premium
Specimens photographs on porcelain—W. L. Goodrich, East Saginaw, Discretionary premium
Pencil drawing of flowers—D. W. Green, Saginaw City..................Discretionary
Frame of card photographs—D. Angell, East Saginaw..................Discretionary
Frame of 9 imperial photographs—D. Angell, East Saginaw.............Discretionary

The undersigned committee on Division K, Class 49, have made as careful an examination of the articles on exhibition as the circumstances would admit. The promiscuous distribution of the articles in this class throughout the hall without reference to light or shade, has made the labor of the committee arduous, and difficult to determine in some cases where the award should be made. Again, we find the classification at variance with the article on exhibition. We find some work of a high order and deserving of more than honorable mention. We have, for some of the above causes, recommended in such cases prizes or premiums. We have not been able to attach the cards of award in many cases, owing to our inability to reach the articles exhibited. The entry on the book will enable you to determine the article and persons to whom awards have been made.

A. S. GAYLORD,
C. T. GORHAM,
F. W. NOBLE,
MRS. HOLLAND,
MRS. PERKINS,
Committee.

CLASS 50.—PHILOSOPHICAL, SURGICAL, AND OTHER INSTRUMENTS AND APPARATUS.

Display of school apparatus—Michigan School Furniture Company, Northville, 1st premium....................Diploma
Specimen artificial teeth—E. L. Baker, Saginaw City, 1st premium...........Diploma

JAMES BIRNEY,
O. L. SPAULDING,
Committee.

CLASS 51.—CLOCKS, JEWELRY, PLATED WARE, CUTLERY, ETC.

Exhibition of fancy glassware—D. V. Kern, Adrian, 1st premium.............Diploma
Display of guns, pistols, revolvers, fishing tackle, etc.—Jesse A. Burdick, East Saginaw, 1st premium....................Diploma
Pair row (oar) locks—J. S. Dougherty, Bay City, 1st premium................Diploma
Show case—Mrs. H. Lowery, East Saginaw, 1st premium......................Diploma
Skeleton clock—A. Rackstraw, East Saginaw, 1st premium....................Diploma
Air gun and target—G. L. Hudson, Romeo, 1st premium.......................Diploma
Parlor telescope—Frederick Harris, East Saginaw, 1st premium..............Diploma

JAMES BIRNEY,
O. L. SPAULDING,
Committee.

CLASS 52.—ARTICLES OF LADIES' DRESS.

Lady's walking dress—Miss C. E. Cleveland, Pontiac, 1st premium	$5 00
Display of millinery goods—Wright & Dawson, Saginaw City, 1st premium...	5 00
Evening dress—Wright & Dawson, Saginaw City, 1st premium................	3 00
Suit of under garments—Miss C. E. Cleveland, Pontiac, 1st premium..........	3 00
Sanitary corset—Mrs. L. E. Polhemus, Ann Arbor, 1st premium................	2 00
Infant's suit—Mrs. A. A. Dunk, East Saginaw, 1st premium	2 00
Display of ladies' dress goods—J. Bauman, Saginaw City, 1st premium......	Diploma
Display of Paisley and Arabian shawls—J. Bauman, Saginaw City.....	Discretionary
Display of ladies' kid gloves—O. N. Hosmer, East Saginaw.............	Discretionary

The goods found in this class exhibit a large degree of skill, and we regret that there were so few entries; and, although in some instances there was no competition, yet the excellence of the work seems to fully justify the award of premiums which has been made. Several articles described could not be found.

MRS. W. A. ARMSTRONG,
MRS. H. N. LATHROP,
MRS. GEO. KATOR,
J. T. COBB,
Committee.

CLASS 53.—PLAIN NEEDLE AND MACHINE WORK.

Specimen plain needle work—Mrs John Gamble, East Saginaw, 1st premium. $3 00
Mrs. A. A. Dunk, East Saginaw, 2d premium 2 00
Fine shirt, all by hand—Mrs. C. G. Hampton, Detroit, 1st premium 2 00
Mrs. J. D. Dates, St. Johns, 2d premium 1 00
Pair plain handkerchiefs—Mrs. C. G. Hampton, Detroit, 1st premium 2 00
P. H. Higby, Adrian, 2d premium 1 00
Silk patchwork quilt, by hand—Mrs. L. W. Simpson, East Saginaw, 1st prem 3 00
Mrs. L. D. Cook, Flint, 2d premium 2 00
Calico patchwork quilt, by hand—Miss Layura Ross, Midland, 1st premium 3 00
Miss Mary Eberhardt, Saginaw, 2d premium 2 00
Worsted patchwork quilt, by hand—Mrs. F. E. Chamberlin, Farmington, 1st premium 3 00
Mrs. Byron Emerson, East Saginaw, 2d premium 2 00
Plain white muslin quilt, by hand—Mrs. Laudry, Saginaw City, 1st premium 3 00
Miss Sadie Davis, East Saginaw, 2d premium 2 00
Plain quilt of any other kind, by hand—Mrs. L. D. Risleay, East Saginaw, 1st premium 3 00
Pair plain sheets, by hand—Mrs. H. B. Chapman, Reading, 1st premium 2 00
Mrs. R. A. Gardner, East Saginaw, 2d premium 1 00
Pair plain pillow-cases or covers—Mrs. C. B. Jones, East Saginaw, 1st prem 2 00
Mrs. J. D. Dates, St. Johns, 2d premium 1 00
Set pillow shams—Mrs. A. A. Parsons, Saginaw City, 1st premium 2 00
Mrs. W. C. McKeller, Paw Paw, 2d premium 1 00
Sample braiding, by hand—Miss E. A. Eddy, East Saginaw, 1st premium 2 00
P. H. Higby, Adrian, 2d premium 1 00
Specimen of hem stitching—Mrs. A. A. Parsons, Saginaw City, 1st premium 2 00
P. H. Higby, Adrian, 2d premium 1 00
Darned stocking—Mrs. A. A. Parsons, Saginaw City, 1st premium 2 00
Fine shirt, by machine—Mrs. F. Raymond, Jr., East Saginaw, 2d premium 2 00
Infant's dress, by machine—Mrs. F. Raymond, Jr., East Saginaw, 1st premium. 2 00
Ornamental patchwork quilt—Mrs. W. Campbell, East Saginaw, 1st premium, Discretionary
Mrs. W. Campbell, East Saginaw, 2d premium Discretionary
Night dress, by hand—P. H. Highby, Adrian, 1st premium Discretionary
Silk patchwork pillow—S. W. Bare, East Saginaw, 1st premium Discretionary

MRS. W. A. ARMSTRONG,
MRS. GEORGE KATOR,
MRS. H. N. LATHROP,
J. T. COBB,
Committee.

CLASS 54.—EMBROIDERY AND ORNAMENTAL NEEDLEWORK.

Collection of ornamental needlework by one person—Miss C. E. Cleveland, Pontiac, 1st premium $10 00
Specimen ornamental needlework in cotton or linen—Miss C. E. Cleveland, Pontiac, 1st premium 3 00
Miss C. E. Cleveland, Pontiac, 2d premium 2 00
Specimen embroidered infant's dress, linen—Mrs. A. A. Dunk, East Saginaw, 1st premium 2 00
Specimen embroidered pillow-cases in cotton—Mrs. Lizzie Comstock, East Saginaw, 1st premium 2 00
Miss C. E. Cleveland, Pontiac, 2d premium 1 00
Specimen embroidered night dress in cotton—Miss C. E. Cleveland, Pontiac, 1st premium 2 00
Miss C. E. Cleveland, Pontiac, 2d premium 1 00
Specimen embroidered handkerchief in linen—Miss Kate Hayden, East Saginaw, 1st premium 2 00
Mrs. S. V. Beach, East Saginaw, 2d premium 1 00
Specimen embroidered letters in marking in cotton—Miss C. E. Cleveland, Pontiac, 1st premium 2 00
Miss Lizzie Comstock, East Saginaw, 2d premium 1 00
Specimen silk embroidery—Miss C. E. Cleveland, Pontiac, 1st premium 3 00
Miss Emma Rienschnider, Saginaw City, 2d premium 2 00
Specimen embroidered infant's dress, in silk—Miss C. E. Cleveland, Pontiac, 1st premium 2 00

Specimen embroidered infant's blanket, in silk—Miss C. E. Cleveland, Pontiac, 1st premium	$2 00
Specimen embroidered piano or table cover in silk—Mrs. W. H. Downs, East Saginaw, 1st premium	2 00
Mrs. E. R. Gould, Saginaw City, 2d premium	1 00
Specimen chenille embroidery in silk—Mrs. James B. Peter, East Saginaw, 1st premium	2 00
Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Specimen worsted embroidery—Mrs. Israel N. Smith, Saginaw City, 1st prem.	3 00
Miss C. E. Cleveland, Pontiac, 2d premium	2 00
Sample pictures worked in worsted—Mrs. A. Milner, East Saginaw, 1st prem.	3 00
Miss Emma Rienschnider, Saginaw City, 2d premium	2 00
Sample cut or raised work in worsted—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Miss C. E. Cleveland, Pontiac, 2d	1 00
Sample pair toilet mats in worsted—Mrs. W. H. Downs, East Saginaw, 1st premium	2 00
Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Sample pair lamp mats in worsted—Miss C. E. Cleveland, Pontiac, 1st prem.	2 00
Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Sample toilet cushion in worsted—Mrs. C. B. Jones, East Saginaw, 1st prem.	2 00
Mrs. Israel N. Smith, Saginaw city, 2d premium	1 00
Sample chair or ottoman cover in worsted—Miss C. E. Cleveland, 1st premium.	2 00
Mrs. H. Lowry, East Saginaw, 2d premium	1 00
Sample pair slippers—Miss C. E. Cleveland, 1st premium	2 00
Miss C. E. Cleveland, 2d premium	1 00
Sample work on perforated board, in worsted—Mrs. F. Raymond, Jr., East Saginaw, 1st premium	2 00
Miss C. E. Cleveland, 2d premium	1 00
Sample chair tidy in worsted—Mrs. Israel N. Smith, Saginaw City, 1st prem.	2 00
Mrs. Mary Ringler, Saginaw City, 2d premium	1 00
Sample towel rack—Mrs. Mary Ringler, Saginaw City, 1st premium	2 00
Miss C. E. Cleveland, 2d premium	1 00
Sample stool cover—Miss E. A. Eddy, East Saginaw, 1st premium	2 00
Miss C. E. Cleveland, 2d premium	1 00
Sample embroidered bracket in silk—Mrs. Israel N. Smith, Saginaw, 1st prem.	2 00
Mary Moross, East Saginaw, 2d premium	1 00
Sample embroidered wall basket—Miss Menia Rienschnider, Saginaw City, 1st premium	2 00
Mrs. M. L. Driggs, East Saginaw, 2d premium	1 00
Sample infant's embroidered cloak—Mrs. H. Lowery, East Saginaw	Discretionary
Embroidered boot-jack—Emma Rienschnider, Saginaw City	Discretionary
Embroidered fire screen, bead and worsted—Mrs. Frank Bennett, Saginaw City, 2d premium	Discretionary
Specimen embroidered yoke ladies' undergarment—Miss Layura Ross, Midland	Discretionary
Wash stand splasher—Mrs. M. A. Lawrence, East Saginaw	Discretionary
Embroidered stove screen—Mrs. Emma Rienschnider, Saginaw City	Discretionary
Gent's quilted dressing gown—Mrs. C. B. Hadley, East Saginaw	Discretionary
Sample sofa or pillow cover—Miss Emma Rienschnider, Saginaw City, 2d premium	$1 00

We, the undersigned committee, have thoroughly and carefully examined all entries made in this class. The entries are very numerous, and, as a class, very meritorious, and for this reason the committee have found great difficulty in deciding where to bestow the limited number of premiums, and, consequently, many articles which merit a first or second premium are left without any. We have, however, endeavored to do our duty conscientiously in the premises, and have made our awards as indicated in the report above.

GEO. H. DURAND,
MRS. R. G. HART,
MRS. B. B. BUCKHOUT,
MISS EMMA J. ADAMS,
Committee.

CLASS 55.—CROCHET, KNIT, AND FANCY WORK.

Largest collection of work in this class made by one person—Mrs. Mary Ringler, Saginaw City, 1st premium	$5 00
Miss C. E. Cleveland, Pontiac	Discretionary
Display crochet articles—Mrs. Townsend North, Vassar, 1st premium	$3 00
Alice Perkins, East Saginaw, 2d premium	2 00
Gent's scarf—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Gent's scarf—Mrs. Townsend North, Vassar, 2d premium	1 00
Afghan robe—Mr. H. Coleman, East Saginaw, 1st premium	3 00
James B. Peter and Miss Webber, East Saginaw, 2d premium	2 00
Child's Afghan robe—Mrs. L. W. Simpson, East Saginaw, 2d premium	2 00
Pair crochet toilet mats—Mrs. A. A. Dunk, East Saginaw, 2d premium	1 00
Pair crochet lamp mats—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Mrs. W. C. McKellar, Paw Paw, 2d premium	1 00
Crochet or knit hood—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Mrs. H. Lowery, East Saginaw, 2d premium	1 00
Crochet or knit shawl—Miss E. A. Eddy, East Saginaw, 1st premium	2 00
Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Crochet or knit child's sack—Miss A. D. Gullier, East Saginaw, 1st premium	2 00
Miss H. Lowery, East Saginaw, 2d premium	1 00
Crochet infant's boots—Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Crochet infant's shirts—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Pair crochet mittens—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Crochet child's cap—Mrs. H. Lowery, East Saginaw, 1st premium	1 00
Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Sample plain knitting—Mrs. C. G. Hampton, Detroit, 1st premium	2 00
Sample ornamental knitting—Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Crochet cloak—Miss C. E. Cleveland, Pontiac, 1st premium	2 00
Fancy pin cushion—Mrs. Alfred W. Newton, East Saginaw, 1st premium	2 00
Mary C. Yawkey, East Saginaw, 2d premium	1 00
Fancy bead-work hanging basket—Mrs. W. C. McKellar, Paw Paw, 1st premium	2 00
Miss C. E. Cleveland, Pontiac, 2d premium	1 00
Fancy bead cushion—Mrs. Israel N. Smith, Saginaw City, 1st premium	2 00
Mrs. F. Raymond, Jr., East Saginaw, 2d premium	1 00
Fancy bead book-mark—Emma Rienschnider, Saginaw City, 1st premium	1 00
Mrs. F. Raymond, Jr., East Saginaw, 2d premium	50
Knitted motto in plain colors—Mrs. H. Lowery, East Saginaw	Discretionary
Knitted motto shaded—Mrs. H. Lowery, East Saginaw, 2d premium	Discretionary
Crochet scrap bag—Mrs. H. Lowery, East Saginaw	Discretionary
Crochet child's skirt—Mrs. H. Lowery, East Saginaw	Discretionary
Crochet infant's bonnet—Mrs. H. Lowery, East Saginaw	Discretionary
Crochet infant's suit—Mrs. H. Lowery, East Saginaw	Discretionary
Crochet muff—Mrs. H. Lowery, East Saginaw	Discretionary
Worsted driving reins—Mrs. L. Burrows, Jr., Saginaw City	Discretionary
Silk wreath—Mrs. H. Lowery, East Saginaw	Discretionary
Toilet set, four pieces—Mrs. Alfred W. Newton, East Saginaw	Discretionary
Knit silk gloves—Kathrina Herpel, Taymouth, Saginaw county	Discretionary
Pair knit cotton stockings—Kathrina Herpel, Taymouth	Discretionary
Crochet edging (apron)—Emma Reinschnider, Saginaw City, 2d premium	Discretionary
Beaded slippers—Mrs. S. A. Beard, East Saginaw	Discretionary
Linen tidy in worsted—Mrs. W. S. Fish, Saginaw City	Discretionary
Cotton tidy, "Daisy"—Miss E. A. Eddy, East Saginaw	Discretionary
Cotton tidy, crochet—Miss A. D. Gulliver, East Saginaw, 1st premium	Discretionary
Miss E. A. Eddy, East Saginaw, 2d premium	Discretionary
Cotton tidy, Java canvas—Miss Sadie Davis, East Saginaw, 1st premium	Discretionary
Miss Lelia Crabb, East Saginaw, 2d premium	Discretionary
Mrs. Mary Ringler, Saginaw City, 1st premium	Discretionary
Alice Perkins, East Saginaw, 2d premium	Discretionary
Cotton tidy, crochet—Mrs. Wm. H. Beach, East Saginaw, 1st premium	Discretionary
Worsted tidy—Mrs. D. K. Halsey, East Saginaw, 1st premium	Discretionary
W. S. Fish, Saginaw City, 2d premium	$1 00
Crochet mittens, ornamental—Mrs. Richard Elliott, Lansing	Discretionary

The undersigned committee, appointed for the year 1875 to consider the merits of the several articles in this class, respectfully submit that they have, during their

labors of nearly three days, carefully examined each article of the foregoing class, and the several collections entered in such, and that they have found many articles in kind of nearly equal merit, and have deemed it most judicious to recommend the several articles for premiums as hereinbefore mentioned.

L. F. DURAND,
MRS. L. WOODWARD,
MRS. J. C. DAYTON,
Z. A. GOFFE,
C. S. CHAMBERLAIN,
Committee.

CLASS 56.—HAIR, SHELL, AND WAX WORK.

Hair wreath—Mrs. A. A. Parsons, Saginaw City, 1st premium........ $2 00
Mrs. S. A. Beach, East Saginaw, 2d........ 1 00
Display of wax work—pond lilies, Mrs. C. B. Headley, East Saginaw, 1st premium........ 3 00
Lily, Mary Moross, East Saginaw, 2d........ 1 00
Display of wax flowers in vase—Mrs. F. W. Seabring, Saginaw city, 1st premium........ 2 00
Hannah Wills, East Saginaw, 2d........ 1 00
Display of wax flowers in wreath—Mrs. F. W. Seabring, Saginaw, 1st premium 2 00
Matilda Wrege, East Saginaw, 2d........ 1 00
Display of fruit in wax—Hannah Wills, East Saginaw, 1st premium........ 3 00
Artificial flowers in silk, muslin, paper, or feather—Wright & Dawson, Saginaw, 1st premium........ 2 00
Feather bouquet—Miss Mary E. McGuire, Saginaw city, 2d........ 1 00
Specimen worsted or chenille flowers—Miss Maud Sawyer, East Saginaw, 1st premium........ 2 00
Mrs. F. W. May, Chesaning, 2d........ 1 00
Ornamental shell work—Mrs. S. A. Beard, East Saginaw, 1st premium........ 2 00
Wreath seed flowers—Mrs. L. N. Newkirk, Wahjamega, 1st premium........ 2 00
Miss Mary E. McGuire, Saginaw city, 2d........ 1 00
Bouquet of dried grasses and plants—Mrs. A. A. Parsons, Saginaw city, 1st premium........ 2 00
Mrs. Richard Elliott, Lansing, 2d........ 1 00
Crystallized cross in moss, etc, Maud Sawyer, East Saginaw........Discretionary
Combination picture—mosses and shells from Pacific Ocean, Mrs J. W. Willard, Brooklyn........Recommend
Same—Mrs. J. W. Willard........Recommend
Same—Mrs. J. W. Willard........Recommend
Same—Mrs. J. W. Willard........Recommend
Display of wax autumn leaves in wreath—Mary Moross, East Saginaw...Recommend
Wreath seed flowers embalmed—Mary Moross, East Saginaw........Recommend
Wreath—feather, Mrs. M. L. Wrege, East Saginaw........Recommend
String love-buttons—1,657, Mrs. A. A. Dunk, East Saginaw, 1st premium. Discretionary
Collection of stuffed birds—J. J. Hall, South Saginaw........Recommend

We, the undersigned committee, having carefully examined the list of articles given in our class, No. 56, find all possessing merits worthy of favorable mention, and several deserving of premiums beyond that which we were permitted to allow. We have awarded the premiums in accordance with our best judgment.

ROBERT CAMPBELL,
MRS. JANE CULVER,
MISS C. E. CLEVELAND,
MRS. M. E. WINCHESTER,
Committee.

CLASS 57—PRINTING AND STATIONERY.

Specimen leather binding—bible, Frank H. Rose, Lansing, 1st premium......Diploma
Set blank books, T. Busch, Saginaw city, 1st premium........Diploma
Local notice of State Fair of 1875—Saginaw Courier Company, East Saginaw, 1st premium........ $50 00
Michigan Farmer, Detroit, 2d........ 30 00
Monroe Commercial, Monroe, 3d........ 20 00

LE ROY PARKER,
O. L. SPAULDING,
Committee.

CLASS 58.—MISCELLANEOUS ARTICLES.

Specimen sawed lumber, 20 boards—Sears & Holland, East Saginaw, Diploma and $2 00
Specimen steam seasoned—Michigan Steam Seasoning Co., Ionia. Recommend diploma
Specimen dressed lumber, not less than 20 boards—S. H. Mershon, East Saginaw, 1st premium.......Diploma and $2 00
1,000 machine made shingles—E. Andrews, Saginaw City, 1st premium, Diploma and 2 00
Collection of 10 bunches sawed lath—Sears and Holland, East Saginaw, 1st premium....... 3 00
Barrel packers' salt—Sears & Holland, East Saginaw, 1st premium....... 5 00
Sample table salt—H. Goldsmith & Co., Saginaw City, 1st premium....... 5 00
Barrel time kettle salt—J. M. Moore, Bay City, 1st premium....... 5 00
Barrel solar salt—East Saginaw Manufacturing Co., East Saginaw, 1st prem.. 5 00
Wrought iron fence of Michigan manufacture—C. A. Koehler, East Saginaw, 1st premium.......Silver medal
Display of horseshoes, all kinds—Duncan McKenzie, Port Huron, 1st premium. $10 00
  Richard Moxley, East Saginaw, 2d premium....... 5 00
  C. A. Dolliver, East Saginaw.......Recommend premium
  Aleck Birss, East Saginaw.......Recommend premium
Best shod horse—Richard Moxley, East Saginaw, 1st premium....... $10 00
Prepared drain, not less than two rods—A. B. Paine, Saginaw City, 1st prem.. 10 00
Specimen of brick made by machinery—A. B. Paine, Saginaw City, 1st premium.......Diploma
Peavy hook—Philip Garvey, East Saginaw.......Discretionary
Salt barrel—E. J. Gould, Saginaw City.......Discretionary $1 00
One thousand machine racked hoops—J. A. Brown, Hemlock City. Discretionary 1 00
Sample 3 cider pails—Alma Cedar Works, Alma.......Discretionary
Specimen of chilled iron for plow castings—Gale Manufacturing Co., Albion, Recommend medal
Sample stock brick—John Barr, Saginaw City, discretionary.......Diploma
Ten sets salt barrel heading—Sears & Holland, East Saginaw, 1st premium, Discretionary
Ten sets salt barrel staves—Sears & Holland, East Saginaw, 1st premium. Discretionary
Sample boiled hoops—Geo. E. Stewart, County Line, discretionary.......Diploma
Light pleasure boat (clinker built)—S. E. Burnham, Saginaw City.......Discretionary
One pair spoon oars—S. E. Burnham, Saginaw City.......Recommend 1st premium
Williams' fruit evaporator—Geo. H. Clark, South Haven.......Recommend premium
Champion carpet stretcher—Champion Manufacturing Co., Buchanan, Recommend diploma
Barrel fine salt—Owen & Brewer, East Saginaw, 1st premium.......Discretionary
  E. F. Gould, Saginaw City.......Diploma
  Wm. M. Reed, East Saginaw, recommend 1st premium.......Discretionary
Barrel fine salt (pan)—Sears & Holland, East Saginaw, recommended 1st premium.......Discretionary

I. W. VAN FOSSEN,
D. WOODMAN,
ASA CROFOOT,
Committee.

MATERIAL AND FINANCIAL EXHIBIT, 1875.

The Twenty-seventh Annual Fair of this Society, and the second of the series in the Saginaw Valley, held at East Saginaw, commenced on Monday, the 13th day of September, and continued, by force of circumstances, through the week, as an exhibition of the products of the varied industries of Michigan, may be considered to have been a great success; more than realizing the most sanguine anticipations of those having it in immediate charge. The opening days, Monday, Tuesday, and Wednesday, gave promise of an attendance fully equal to that of other years, and on Thursday the people thronged the grounds; the

thousands endured the inclemency of the pitiless storm from morning till night, returning to their homes drenched, cold, wearied, and dispirited, and the public interest in the fair was dissipated. The fair, so far as the general public were concerned, may be said to have ended with its first exhibition day. The subsequent days, Friday and Saturday, were principally devoted to fulfilling the obligations of the Society to exhibitors, which important duties were well and faithfully performed, as the subsequent tabular statement will show, regardless of consequences to the Society.

Without further remark upon the misfortune of bad weather or its disastrous results to the Society financially, I submit in detail the material and financial exhibit for the year.

TABULAR EXHIBIT OF PREMIUMS OFFERED AND AWARDED.

Statement of Number of Entries and Amount of Premiums Offered and Awarded in each Class, and a Summary of Premiums and Awards by Divisions.

Class.	Division.	Entries.	Premiums Offered.			Premiums Paid.		
			Money.	Diploma.	Medal.	Money.	Diploma.	Medal.
	DIVISION A.—CATTLE.							
1	Shorthorns	53	$379 00	1	....	$349 00	1	....
2	Devons	30	379 00	1	....	325 00	....	....
3	Herefords	15	379 00	1	....	231 00	....	....
4	Ayrshires	18	270 00	1	....	140 00	....	....
5	Alderneys	7	270 00	1	....	98 00	....	....
6	Galloways	7	257 00	1	....	66 00	....	....
7	Grade and Native Cattle	16	97 00	1	....	71 00	1	....
8	Working Oxen and Steers	7	143 00	....	....	80 00	....	....
9	Fat Cattle	7	267 00	....	....	175 00	....	....
10	Herds No. 1	4	280 00	....	....	240 00	....	....
....	Herds No. 2	......	20 00	....	....	20 00	....	....
		164	$2,741 00	7	....	$1,795 00	2	....
	DIVISION B.—HORSES.							
11	Thoroughbreds	13	$368 00	....	....	$145 00	....	....
12	All work	34	474 00	....	....	472 00	....	....
13	Roadsters	68	472 00	....	....	440 00	....	....
14	Gents' Driving	41	205 00	....	....	155 00	....	....
15	Draft	31	701 00	....	....	511 00	....	....
16	Carriage and Buggy	21	305 00	....	....	250 00	....	....
17	Saddle	5	45 00	....	....	45 00	....	....
18	Jacks and Mules	1	104 00	....	....	10 00	....	....
		184	$2,674 00	....	....	$2,028 00	....	....
	DIVISION C.—SHEEP AND SWINE.							
19	American Merinos	89	$252 00	....	....	$252 00	....	....
20	Southdown and other middle-wooled sheep	38	147 00	....	....	147 00	....	....
21	Cotswold, Leicester, and other long-wooled	31	177 00	....	....	173 00	....	....
22	Fat	4	31 00	....	....	31 00	....	....
23	Berkshire, Essex, Suffolk, and Fat	42	346 00	....	....	216 00	....	....
		204	$953 00	....	....	$819 00	....	....
	DIVISION D.—POULTRY.							
24	Poultry	106	$332 00	6	....	$107 00	....	....

TABULAR EXHIBIT OF PREMIUMS—*Continued.*

Class.	Division.	Entries.	Premiums Offered.			Premiums Paid.		
			Money.	Diploma.	Medal.	Money.	Diploma.	Medal.
	DIVISION E.—FARM PRODUCTS.							
25	Grains and Seeds	66	$239 00	3	....	$122 00	3	....
26	Roots and Vegetables	523	322 00	2	....	293 00	2	....
27	Flour, Meal, and Feed	6	50 00	....	....	13 00	....	....
28	Butter and Cheese	30	165 00	....	1	165 00	....	1
29	Sugar, Honey, and Bee Hives	10	31 00	1	....	18 00	1	....
30	Bread and Pickles	42	43 00	3	....	37 00	3	....
31	Soap and Toilet Articles	6	....	8	....	....	2	....
32	Miscellaneous	8	....	....	....	....	2	....
		691	$850 00	17	1	$648 00	12	1
	DIVISION F.—FARM IMPLEMENTS.							
33	Plows	35	$195 00	10	....	$185 00	3	....
34	Tillage Implements	24	166 00	6	....	163 00	3	....
35	Seed Drills, Planters, etc	24	115 00	9	....	110 00	5	2
36	Haying and Harvesting Implements	52	45 00	8	4	45 00	3	2
37	Sundry Farm Machinery	40	110 00	8	6	85 00	2	1
38	Miscellaneous	36	94 00	19	1	62 00	4	1
39	Dairy and Household	16	....	32	....	....	4	....
		227	$725 00	92	11	$650 00	24	6
	DIVISION G.—VEHICLES.							
40	Vehicles	42	$185 00	11	....	$103 00	9	....
	DIVISION H.—MACHINERY.							
41	Machinery for working iron	76	....	34	30	....	6	7
42	Railroad rolling stock	1	....	5	2	....	....	....
		77	....	39	32	....	6	7
	DIVISION I.—MANUFACTURED GOODS.							
43	Home-made	51	$121 00	....	....	$46 00	....	....
44	Factory made	9	106 00	14	4	35 00	3	2
45	Articles of Dress	9	23 00	2	4	14 00	2	....
46	Articles of Leather and India Rubber	28	61 00	7	1	29 00	3	....
47	Articles of Furniture	28	232 00	9	2	82 00	5	3
48	Stoves and Iron Work	13	39 00	6	5	17 00	3	3
		138	$582 00	38	16	$223 00	16	8
	DIVISION J.—MUSICAL INSTRUMENTS.							
48½	Musical Instruments and Sewing Machines	10	....	....	....	....	....	....
	DIVISION K.—PAINTING, NEEDLEWORK, &c							
49	Painting and Sculpture	142	$460 00	16	....	$219 00	1	....
50	Philosophical, Surgical, and other instruments	52	....	28	....	....	2	....
51	Clocks, Jewelry, etc	7	15 00	9	....	....	7	....
52	Articles of Ladies' Dress	11	85 00	1	....	20 00	1	....
53	Plain Needle and Machine Work	95	96 00	....	....	46 00	....	....
54	Embroidery and Ornamental Needlework	208	135 00	....	....	96 00	....	....
55	Crochet, Knit, and Fancy Work	231	98 50	....	....	92 50	....	....
56	Hair, Shell, and Wax Work	48	63 00	1	....	42 00	....	....
57	Printing and Stationery	8	100 00	16	....	100 00	2	....
		752	$1,052 50	71	....	$615 50	13	....
	DIVISION L.—MISCELLANEOUS ARTICLES.							
58	Miscellaneous	61	$122 00	27	5	$70 00	8	2

SUMMARY BY DIVISIONS.

DIVISIONS.	Entries.	Premiums Offered. Money.	Premiums Offered. Diploma.	Premiums Offered. Medal.	Premiums Paid. Money.	Premiums Paid. Diploma.	Premiums Paid. Medal.
Division A.—Cattle	164	$2,741 00	7	....	$1,795 00	2	....
B.—Horses	184	2,674 00	....	....	2,028 00	....	....
C.—Sheep and Swine	204	953 00	....	....	819 00	....	....
D.—Poultry	106	332 00	6	....	107 00	....	....
E.—Farm Products	691	850 00	17	1	648 00	12	1
F.—Farm Implements	227	725 00	92	11	650 00	24	6
G.—Vehicles	42	185 00	11	....	103 00	9	....
H.—Machinery	77	....	39	32	....	6	9
I.—Manufactures	138	582 00	38	16	223 00	16	8
J.—Musical Ins'ments and Sewing Machines	10	....	....	....	....	....	....
K.—Painting, Needlework, and art generally	752	1,052 50	71	....	615 50	13	....
L.—Miscellaneous	61	122 00	27	5	70 00	8	2
Totals	2,656	$10,216 50	308	65	$7,058 50	90	26
Speed Department	......	5,045 00	....	....	4,785 00	....	....
Grand Totals	......	$15,261 50	....	....	$11,843 50	....	....

From the foregoing it will be seen that the total of ordinary premiums offered amounted to $10.216 50
That the amount awarded was 7,058 50

Showing an excess of premiums offered over awards $3,158 00

The premiums offered as speed prizes amounted to $5,045 00
The awards amounted to 4,785 00

Showing as excess of premiums over awards $260 00

The speed awards amounted to $4,785 00
The percentage derived from entries in this department amounted to 2,402 00

Showing the net appropriation in this department, or its cost to the society to be $2,383 00

It may be proper here to remark that the foregoing numerical statement of the number of entries does not enumerate the number of individual articles on exhibition by at least thirty-three per cent, arising from the fact that a large number of collection and sweepstake entries cover dozens, and in several instances hundreds of articles in a single entry or block.

FINANCIAL EXHIBIT.

The following is a detailed statement of the expenditures, embracing all business orders drawn and appropriations made during the current year, giving date, number, and amount of each order, and for what drawn, and in whose favor.

Voucher No.		Amount.
1	J. E. Wells, East Saginaw, marshals and police 1874	$20 00
2	John P. Allison, East Saginaw, services renting booths	100 00
3	C. S. Draper, East Saginaw, meals furnished by ladies of St. Paul's Church	500 50
4	Wm. H. Sotham, Detroit, services as Assistant Superintendent	25 00
5	M. D. Brown, services as Assistant Superintendent	31 85
6	Pontiac Gazette Company, rent of office, 1873 and 1874	100 00
7	A. J. Dean, Treasurer, expenses of winter meeting 1874	385 50
8	Wright C. Allen, North Michigan Agricultural account	15 00
9	Milwaukee Herald Co., " " " "	2 00
10	Geo. Willard & Co., " " " "	2 00
11	John H. Mitchell, " " " "	2 00
12	Michigan Stove Co., Detroit, erecting building for display of stoves	20 00
13	Charles Kipp, St. Johns, Executive Committee account	5 63

Voucher No.			Amount.
14	A. W. Burtt, Pontiac, Secretary's clerk		$17 50
15	A. A. Parsons, Saginaw, lumber		2 00
16	Wm. Smith, paid for exhibiting stock		150 00
17	J. D. Mizner, Burr Oak, refunded freight		16 00
18	D. C. Morehouse, refunded freight		11 60
19	John Button, refunded freight		18 78
20	John P. Sanborn, Port Huron, refunded freight		62 55
21	Avery & Murphy, Detroit, refunded freight		62 50
22	E. Driggs, Adrian refunded freight		3 11
23	Robert Moore, Adrian, refunded freight		3 66
24	C. F. Kimball, Secretary—traveling expenses	$2 50	
	postage	5 64	
	expressage	90	
			9 04
25	Pontiac Gazette Company, stationery, Executive Committee		14 50
26	J. M. Sterling, Monroe, Business Committee expenses at Port Huron		33 00
27	J. M. Sterling, Monroe, Business Committee expenses at Lansing		21 70
28	State Pomological Society—from appropriation		300 00
29	M. S. Smith & Co., Detroit, two base ball badges		75 00
30	Richmonds & Backus, Detroit, eight file boxes		2 16
31	C. F. Kimball, salary of Secretary, 1st quarter, 1875		250 00
32	J. M. Sterling, Monroe, Business and Transportation Com. expenses		31 70
33	Israel B. Norcross, East Saginaw, entertaining Executive and Business Committee		19 25
34	C. F. Kimball, salary of Secretary, 2d quarter, 1875		250 00
35	Pontiac Gazette Company, printing State Fair Premium Lists, 1875, as per contract of Printing Committee		425 00
36	Pontiac Gazette Co.—Executive Committee stationery	$11 50	
	stationery for Secretary	10 75	
	printing ordinary circulars, etc.	22 00	
			44 25
37	Pontiac Postoffice, postage stamps		38 43
38	J. M. Sterling, Monroe—telegraphing	$0 60	
	postage	3 75	
	Business Committee expenses	33 00	
			37 35
39	State Pomological Society, from appropriation		500 00
40	J. M. Sterling, Business Committee expenses		48 00
41	Pontiac Postoffice, stamps and wrappers		65 17
42	C. F. Kimball, expressage paid		8 25
43	J. M. Sterling, Business Committee expenses		19 40
44	J. M. Sterling—expressage	$1 20	
	telegraphing	1 80	
	postage	5 06	
			8 06
45	C. L. Lull, East Saginaw, hotel bill, Executive Committee		19 50
46	Kalamazoo Telegraph Publishing Co., printing State Fair bills		155 00
47	Pontiac postoffice, postage stamps		28 28
48	Sears & Holland, East Saginaw, lumber		305 82
49	F. M. Manning, Paw Paw, Executive Committee expenses		28 50
50	Abel Angel, Allegan Co., Executive Committee expenses		10 21
51	Henry C. Ripley, East Saginaw, baled hay		11 10
52	Michigan Farmer, Detroit, newspaper advertising		25 00
53	A. J. Templeton, East Saginaw, team work		6 25
54	A. J. Dean, Adrian, Board of Employes		50 75
55	Wickes Bros., power for Machinery Hall		598 00
56	Home for the Friendless, lunch room expenses		180 39
57	D. A. Blodgett, Hersey, Executive Committee expenses		10 45
58	J. Bauman, Saginaw City, hall trimming		1 40
59	Geo. W. Phillips, Romeo, Executive Committee expenses		14 75
60	J. G. Ramsdell, Grand Traverse, Executive Committee expenses		39 90
61	Charles Rarick, East Saginaw, carpenter work		12 00
62	State Pomological Society, from appropriation		500 00
63	Pierson & Beahan, Flint, forage		944 00

Voucher No.			Amount.
64	J. Webster Childs—Executive Committee expense	$11 00	
	marshals and police	19 00	
			$30 00
65	A. O. Hyde, Marshall—Executive Committee expense	$27 05	
	expressage	3 65	
			30 70
66	D. W. Howard, Pentwater, Executive Committee expenses		13 45
67	J. C. Dayton, East Saginaw, marshal and police expenses		25 00
68	J. Q. A. Burrington—Executive Committee expenses	$7 25	
	marshal and police	2 00	
			9 25
69	Curtis Barnes—rent of outside booth ground	$75 00	
	Executive Committee expenses	3 00	
			78 00
70	E. W. Rising, Executive Committee expenses		12 25
71	James Rising, carpenter work		2 00
72	F. & P. M. R. R., freight on forage		70 00
73	E. W. Rising—forage account expenses	$50 50	
	marshal and police account	4 50	
			55 00
74	Charles Dickey, Executive Committee expense		5 75
75	C. W. Greene—marshals and police	$18 00	
	board of employés	6 00	
			24 00
76	O. F. Jewell, East Saginaw, team account		15 00
77	C. Kallahan, East Saginaw, marshal and police account		10 00
78	Schuyler Mann, East Saginaw, marshal and police account		12 00
79	W. J. Bartow, East Saginaw, team work		7 00
80	C. W. Greene, Executive Committee expense		9 25
81	J. H. Collins, marshal and police expense		20 00
82	Wm. M. Ferry, Executive Committee expense		6 00
83	W. A. Armstrong & Bro., East Saginaw, meal tickets		28 80
84	Charles Soper, marshal and police account		20 00
85	J. R. Martin, hack fare		10 00
86	Isaac Williamson, dinner tickets		7 20
87	N. Waters, East Saginaw, employment account		10 00
88	P. M. Coult, East Saginaw, employment account		8 75
89	Asahel Rust, East Saginaw, team work		10 00
90	William Hessler, East Saginaw Band, 5 days		250 00
91	Edwin Phelps, Pontiac—Executive Committee expenses	$11 90	
	Assistant Superintendent's expenses	17 20	
			29 10
92	C. E. Cleveland, Pontiac, making badges		11 92
93	T. E. Doughty, East Saginaw, office stationery		6 20
94	Secretary Executive Committee bills—H. O. Hanford	$5 00	
	E. Van Valkenburgh	11 00	
	Warren & Gould	8 25	
	C. L. Whitney	38 65	
	Charles Kipp	9 08	
			71 98
95	S. T. Chapin—services of clerks to Secretary	$479 75	
	marshals and police	34 00	
			513 75
96	Mrs. John Gamble, board of employés		117 00
97	W. U. Telegraph Co., telegraphing		17 56
98	Courier Co., East Saginaw—news advertising	$8 08	
	ordinary printing	64 85	
			72 93
99	W. S. Albertson, office stationery		5 35
100	Wright & Dawson, Saginaw, trimming for halls		3 33
101	Harvey & Coleman, livery and hack hire		9 00
102	Harvey & Coleman, livery and hack hire		7 50
103	A. J. Dean, meal ticket expenses		430 40
104	Detroit Tribune, newspaper advertising		48 00

Voucher No.			Amount.
105	F. A. Palmer, East Saginaw—newspaper advertising	$5 60	
	ordinary printing	27 25	
			$32 85
106	Toledo Commercial, newspaper advertising		7 50
107	Dowd Bros., Pontiac, ribbon for badges		16 04
108	Detroit Paper Co., office stationery		1 75
109	Adrian Times and Expositor, newspaper advertising		8 70
110	Wm. Bishop, East Saginaw, board of employés		30 40
111	M. J. Bird, East Saginaw, lumber and building account		11 52
112	John Owen, East Saginaw, team and hack account		9 60
113	N. E. Deuell & Co., team and hack account		33 75
114	A. J. Dean, paid rent for outside booth ground		125 00
115	J. M. Sterling—postage	$2 50	
	expressage and bill posting	22 44	
			24 94
116	Adrian Times Printing Co., ordinary printing		52 75
117	John P. Allison, East Saginaw—employment account	$33 00	
	postage	1 50	
	sundry fair expenses	16 55	
			51 05
118	C. W. Green, forage		6 00
119	C. F. Kimball—telegraphing	$1 54	
	postage	1 49	
	express and bill posting	3 00	
	sundry fair expenses	42 79	
			48 82
120	A. J. Dean, paid gate-keepers		167 50
121	A. J. Dean, paid marshals and police		306 50
122	Omnibus line, team and hack hire		31 50
123	Everett House, East Saginaw, Executive Committee expenses		68 25
124	Western Union Telegraph Co., telegraphing		2 05
125	Stinson & Bridgman, sundry fair expenses		9 98
126	C. B. Choate, East Saginaw, hardware		65 08
127	S. H. Treadwell, East Saginaw, sundry fair expenses		2 80
128	Morley Bros., East Saginaw, sundry fair expenses		2 00
129	Wm. Bishop, East Saginaw—board employés	$20 30	
	meal tickets	2 00	
	team work	6 00	
	Assistant Superintendent	19 00	
			47 30
130	J. P. Allison, services renting booths		100 00
131	Bancroft House, Executive Committee entertainment		531 00
132	A. J. Dean—Treasurer's clerk hire	$255 00	
	team and hack hire	31 82	
			286 82
133	Feige Bros., East Saginaw, use of chairs and tables		10 00
134	M. Rudd, East Saginaw, team hire		20 00
135	A. J. Dean—National Association fee	$50 00	
	Assistant Superintendents' account	22 00	
	postage	7 60	
	sundry expenses fair	71 00	
			150 60
136	J. M. Sterling—postage	$4 53	
	telegraphing	90	
	Business Committee expenses	9 75	
			15 18
137	Oliver Guyer—board employés	$40 00	
	team hire	11 00	
	carpenters' work	335 70	
	lumber and building material	3 70	
	sundry expenses fair	13 75	
			404 15
138	Calvert Lithographing Co., Detroit, diplomas		90 75
139	A. J. Dean, Business Committee expenses		15 40

Voucher No.			Amount.
140	U. S. Mint, 30 silver medals		$171 50
141	Pontiac Gazette Co.—Executive Committee stationery	$4 00	
	office stationery	6 70	
	ordinary printing	32 85	
			43 55
142	O. S. Gulley, Detroit, printing tickets		49 86
143	C. F. Kimball, rent of office for 1875		50 00
144	C. F. Kimball—telegraphing	$3 66	
	expressage	2 50	
	team hire	2 00	
			8 55
145	C. F. Kimball, salary of Secretary	$316 40	
146	C. F. Kimball, for third and fourth quarters, 1875	183 60	
			500 00
147	St. Paul's Church, East Saginaw, use of hall for election purposes		25 00
148	Pontiac postoffice, postage stamps and wrappers		40 33
149	Adrian Times, ordinary printing		3 00
150	Michigan Farmer, newspaper advertising, printing premium awards for 1875		100 00
151	A. J. Dean—marshal and police	$6 00	
	expressage	2 85	
	Executive Committee èxpenses	10 00	
			18 85
152	A. J. Dean—expressage and postage	$18 15	
	telegraphing	1 40	
	sundry expenses fair	14 49	
			34 04
153	A. J. Dean, Treasurer's clerks and office expenses for 1874		503 27
154	Wm. Bishop, employment account, cleaning grounds and putting track in order		47 00
155	East Saginaw Driving Park Association, one-half grand stand received		322 92
156	State Pomological Society, balance appropriation		200 00
157	A. O. Hyde, business commissioner's expenses		4 30
158	Taylor House, Saginaw City,		24 00
159	Wm. L. Webber, carpentry work, preparing buildings for exhibition		32 00
	State Pomological Society, appropriation drawn directly from Treasurer		1,500 00
	Total of appropriations and and business orders		$15,288 16

RECAPITULATION OF EXPENDITURES.

Appropriations to State Pomological Society, 1875	$3,000 00
Meal ticket expenses account	968 90
Executive Committee expense account	1,292 32
Forage account	1,081 60
Secretary's salary, 1875	1,000 00
Marshal and police account	507 00
Secretary's clerk hire account	497 25
Machinery Hall power account	598 00
Ordinary printing account	832 56
Lumber and building material account	408 12
Carpenters' work account	381 70
Treasurer's expense account, 1874	503 27
Half grand stand receipt account	322 62
Treasurer's clerk hire account	255 00
Sundry expense account of the fair	208 36
Booth renting expense account	200 00
Postage account	204 28
Business Committee expense account	259 75
Newspaper advertising account	202 88
Team, hack and livery account	211 42
Employés board account	264 45
Outside booth rent account	200 00
Music account	250 00
Assistant Superintendent's expense account	115 05
Office rent account, three years	180 00

Wm. Smith account	$150 00
Refunded freight account	178 80
Lunch room expense account	180 39
Gate-keeper's expense account	167 50
Medal account	171 50
Diploma account	90 75
Expressage and posting bills	62 94
Ordinary employés account	98 75
Base ball badge expense, 1874	75 00
Northern Michigan Agricultural Society account	21 00
Executive Committee stationery account	35 35
Office stationery account	27 56
Telegraph expense	28 90
Badge and ribbon expense	27 96
National Association membership fee	50 00
Decorating hall expense	4 73
Secretary's traveling expense	2 50
Total	$15,288 16

The foregoing statement represents the expenditures, but not the expenses of the current year. The bills audited by the Executive Committee at the annual meeting in January, embracing expenses for 1874 and previous years, represented by vouchers numbered from one to twenty-four, and vouchers twenty-nine and one hundred and fifty-three, audited by the Business Committee, representing claims of a previous date, amounting to $2,143, of which amount, added to the Pomological appropriation of January last of $3,000, makes $5,143 09, and deducted from the total amount, gives the following exhibit:

Total expenditures	$15,288 16
Less Pomological appropriation, and debts of previous years paid	5,145 09
Leaving as total business expenses, including salary account for current year 1875	$10,143 07

Which amount is but $143 07 in excess of the estimate submitted in my annual report for for 1874.

RECEIPTS BY SECRETARY, 1875.

From 786 membership certificates	$786 00
From speed entries	2,402 50
From herd entries	86 00
From draft sweepstakes	15 00
Total	$3,289 50

Which amount was paid to the Treasurer and his receipts taken for the same.

GENERAL BALANCE SHEET, 1875.

Dr.

To cash in Treasury, January 15, subject to order	$15,628 80
Received by Treasurer from all sources during the year	17,674 22
Total cash	$33,303 02

Cr.

By paid pomological appropriations	$3,000 00	
Business orders to pay previous indebtedness	2,145 09	
Business orders for current year less orders to amount of $1,500 00 included in pomological appropriation above	10,143 07	
Premium checks, payment of premium of previous years ordered by board in January, 1875	835 00	
Premium checks, payment of ordinary premiums, 1875	7,058 50	
Premium checks, speed premiums 1875	4,785 00	
Total expenditures for all purposes		$27,964 66
Dec. 21. Leaving balance in Treasury to the credit of the Society and subject to order		$5,338 36

C. F. KIMBALL,
Secretary.

REPORT OF THE FINANCE COMMITTEE.

The committee on finance, to whom was referred the annual report of the Secretary, would respectfully report that they have carefully examined the same, and compared the stubs of business orders with the vouchers, and the vouchers with the register of business orders issued, as reported, and find the same correct. We have also compared the stubs of premium checks issued with the register of premiums awarded and paid, and find them to agree and correct. We have examined and find the financial balance of the society as follows, as reported by the Secretary, to-wit:

Cash on hand at commencement of fiscal year		$15,628 80
Cash received by Treasurer from all sources during year		17,674 22
Total		$33,303 02
Business orders issued during year	$13,788 16	
Appropriation to Pomological Society drawn directly from Treasurer	1,500 00	
Premium checks issued	12,676 50	
		$27,964 66
Balance in Treasury Dec. 21, 1875, subject to draft by the Society		$5,338 36

[Signed] J. WEBSTER CHILDS,
E. W. RISING,
E. VAN VALKENBURGH,
Finance Committee.

REPORTS FROM COUNTY SOCIETIES.

BARRY COUNTY.

The annual fair of the Barry County Agricultural Society was held on the 29th and 30th of September and October 1st. The weather was fine and the attendance very large, and the exhibition in all respects a good one. There were 1,011 entries and 880 members. The premiums awarded amounted to $809. The following is the

FINANCIAL STATEMENT.

December 28, 1875.

RECEIPTS.

Balance cash on hand last year	$1 21	
For entrance fees for trotting	120 00	
membership tickets	880 00	
gate fees	361 50	
rent of grounds	192 00	
grand stand tickets	30 10	
		$1,584 81

EXPENDITURES.

Paid for lumber and shingles for fence and buildings	$119 47	
labor on fence and buildings	76 65	
labor on grounds and track	233 09	
nails and hardware	20 00	
well and pump	10 00	
grass seed	7 67	
ribbons, stationery and sundries	8 00	
labor during the fair	105 00	
feed for stock	38 17	
printing	106 30	
Secretary's salary	50 00	
trotting premiums	340 00	
other premiums	442 86	
interest on land contract	20 00	
other interest	7 40	
Balance cash on hand	16	
		$1,584 81

OUTSTANDING ORDERS.

To Hastings Horse Association	$39 05	
Premium orders about	27 00	
Unclaimed orders	7 50	
Protested premiums—Parker *vs.* Pratt & Holden	8 00	
		$81 55
Bill for ribbons for badges, etc		2 40
Due on land contract		200 00

OFFICERS FOR 1876.

President—John Keagle.
Vice President—John Dawson.
Secretary—John M. Nevins.
Treasurer—D. Striker.
Marshal—Peter Cramer.
Directors—D. C. Sanborn, Z. B. Hoyt, C. Y. Norris, P. Brown, A. B. Rennock.

BENZIE COUNTY.

The annual fair of the Benzie County Agricultural Society was held in the village of Benzonia, on October 4, 5, and 6, 1875.

The weather at the time of holding the fair proved to be stormy, which prevented as large an attendance as was expected. The exhibition of stock, although not extensive, was good, and showed that some of our farmers take an interest in the kind of stock in which they invest. The display of vegetables was exceedingly good; such turnips, squashes, cabbage and beets are rarely seen, and the forty entries of potatoes were a sight that would make an Irishman long to come to America. The display in the various other departments were all good, but the crowning glory of our fair was the fruit. The 112 entries of choice apples, pears, peaches, plums, and grapes showed that the position assigned our county by the late Chicago Pomological Exposition as one of the ten best counties in the State for fruit growing was not unmerited.

Financially the fair cannot be called a success; but we consider any exhibition that brings together so many of our farmers and makes so favorable a display of our products as well worth the time, trouble and expense incurred. The following is a list of the entries in each department and number of premiums awarded:

	No. Entries.	Prem. Awarded.
Horses	21	8
Cattle	28	8
Sheep	3	3
Swine	7	5
Poultry	6	4
Grain	45	16
Vegetables	102	15
Fruit	112	14
Manufactured articles	40	15
Household products	55	15
Canned fruit	45	13
Flowers	13	8
Miscellaneous	5	1
Entry	...	2
Total	482	127

The annual election resulted in the following choice of officers for the ensuing year:

President—H. C. Farnam, of Benzonia.
Secretary—J. J. Hubbell, of Benzonia.
Treasurer—L. W. Case, of Benzonia.

W. S. HUBBELL, *President.*

J. J. HUBBELL, *Secretary.*

HILLSDALE COUNTY.

In compliance with the provisions of law governing agricultural societies in the State, we herein transmit our report of the Hillsdale County Agricultural Society for the year 1875.

We do this the more cheerfully because an experience of twenty-five years teaches us their value as auxiliaries (when properly managed) in elevating the standard of agriculture in the land; the result of which tends to the moral and social advancement of the people who reap the fruits thereof.

We have so often alluded to the topographical and geological formations of our county, with its natural and acquired advantages, in former reports, that it has become a well understood fact that its adaptability is preëminently for mixed farming. So permanently has this idea become fixed in the minds of the cultivators that he who should venture upon a specialty would be looked upon at once as a person of unsound mind, likely to bring up in a short time at the door of the Kalamazoo reformatory.

The season now closing, unlike its predecessors of the last five years, has been wet and cold in comparison for this latitude, yet the returns are good in quantity, but deficient in quality with most productions.

Our Wheat was unusually good in bushels, but deficient in starch and gluten. showing the effect of an over-supply of moisture.

Our Oats and Peas were very fine, the former threshing in places as high as 80 bushels per acre. The army worm in some localities did serious damage. It was worst on low, clayey or muck lands.

Our Corn had a large growth, but the quality of grain is below the usual standard for this county; the need of warm weather for the early ripening of the grain was very marked.

Our Potato Crop was good; very little damage from the beetle, some not even using remedies.

Our Hay Crop was very good, mostly timothy and June grass, clover having largely run out by the previous dry seasons. This will probably be restored again, as the season has been so favorable that wherever sown it has a fine stand. There is also a broad area of winter wheat sown in the county, and at this writing looks well.

Our Herds are doing very well and multiplying. The short-horn, in its purity with its finest strains, is fast becoming native to the manor born. Foundations are already laid for a number of fine herds in the county. The Jerseys and Ayrshires have their representatives here also.

Our Flocks are being preserved in purity, the fine-wools largely predominating.

This industry is not being crowded, the pressure of the times tending to a small margin on the production of wool.

Our Swine are the best since the organization of the county. The standard improved breeds are the rule. Farmers of course differ as to profit between breeds, but so long as they work on good foundations there is little danger of their going far astray.

Our Poultry Interests, which but a few years since were not deemed worthy the notice of a farmer, has assumed with us magnificent proportions, filling a niche in the pocket for pin-money to the wife and daughters, greater than the dairy products of the county. In no branch of industry has improvement been greater or more radical in profit than in poultry-raising.

Our Mechanical Interests are not in as prosperous condition as we would be pleased to report. The crisis of 1873, with the unsettling of values in its wake, found its victims in this as in every other county in the land. Nearly a half million dollars' worth of machinery is to-day lying idle in the county for want of capital and confidence to keep it in motion.

Our annual fair was held Sept. 28 to Oct. 1st, inclusive. The weather was favorable, and as a whole it was probably the most profitable and instructive fair ever held by the society.

The following exhibit shows the number of entries in each department, with the number of awards therein and amount of premiums paid:

	No. of Entries.	No. of Awards.	Amount.
Cattle—Thoroughbreds	40	26	$147 00
Grades	31	26	95 CO
Horses	149	83	576 00
Sheep—Fine-wools, pens	73	24	60 00
Combing wools, pens	26	18	48 00
Swine—Pens	48	24	85 50
Poultry—Coops	111	58	62 00
Mechanics Hall	203	113	251 00
Agricultural Hall	436	130	140 00
Floral Hall—Domestics	44	24	24 75
Needle-work	129	65	63 00
Paintings	45	35	80 00
Natural Flowers	205	60	65 00
Pomological Hall	783	180	150 00
Total	2,323	866	$1,847 25

Our net receipts were $4,858 43, with $262 13 in the treasury at the commencement of the year. Our disbursements have been as follows:

For premiums of 1874 and 1875 to January 1st	$1,810 69
bonds and interest paid	1,243 89
improvements and repairs	725 00
Secretary's and Treasurer's salaries	325 00
printing	168 80
general expenses of fair	599 60
	$4,872 98

Leaving balance Jan. 1st of $247 58 in treasury. Our liabilities not yet due, $1,500.

The officers for the ensuing year are as follows:

President—Daniel Timons, M. D., of Moscow.
Vice President—John L. Williams, Esq., of Wheatland.
Secretary—F. M. Holloway of Fayette, Hillsdale P. O.
Treasurer—Chas. H. Winchester of Allen.

IONIA COUNTY.

CENTRAL FAIR ASSOCIATION OF HUBBARDSTON.

The gross receipts for the past four years are as follows:

1871, from all sources		$1,539 17
1872, " " "		1,965 25
1873, " " "		2,199 11
1874, loan of J. C. Frank		1,000 00
sales of tickets	$1,704 40	
entrance to races	250 00	
grounds rented	384 00	
Total receipts for 1874		2,338 40
Gross receipts for four years		$9,041 93

DISBURSEMENTS.

Total orders issued to date	$8,255 21
Wm. Patrick on mortgage	650 50
Discount on loan	60 00
Bills paid by officers	76 72
Total	$9,041 93

ITEMS FOR THE PAST YEAR.

Received on loan due Oct. 20, 1877		$1,000 00
Paid to Wm. Patrick	$650 00	
Paid discount	60 00	
Paid B. McMullen, Treasurer	290 00	
Making		1,000 00

ORDERS ISSUED, 1874.

For interest		$76 17
Contingent expenses 1874	$357 38	
Contingent expenses contracted in 1873	75 00	
Total		432 38

Fence account			$3 50
Track account			46 03
Building account			81 93
Premium account previous years		$98 02	
Premium account 1874		707 50	
(Of which $78 25 are yet on hand)			
Total premium account			805 52
Police account			58 75
(Of which $6 returned and credited)			
Gate account			11 40
Race account, all settled but $25			532 50
Total orders issued			$2,048 18
Applied to payment of old debts, about		$249 50	
Expenses about		642 59	
Premiums about		666 09	
Races		490 00	
Total			2,048 18
Receipts	$2,338 40		
Less current expenses	1,799 68		
Balance to loss and gain		$538 72	
Add receipts from loan		290 00	
Making available funds			828 72
There has actually been paid of old debts		$1,026 23	
Deduct available funds		828 72	
Balance			197 51
Orders and accounts surrendered in settlement		$136 67	
Loss and gain		1 40	
Total			138 07
Actually due the Treasurer			$59 44

The indebtedness of the society, though not definitely known, will vary but little from $1,400. The grounds are mortgaged for $1,000 to J. C. Frank of Avon, Oakland county, on which we have to pay an interest of $100 per year until Oct. 20, 1877, when the whole amount becomes due; the balance of the indebtedness is being placed by your finance committee as fast as it is proved and presented.

I have hastily prepared a schedule of expenses for the past three years, which I place beside the receipts for the corresponding year, thus showing you approximately the relation they have to each other, and giving you a basis from which to average a proportion of increase:

1872, receipts about		$1,965 25
expenses about	$642 53	

1873, receipts about		$2,199 11
expenses about	$1,117 60	
1874, receipts about		2,338 40
expenses about	$642 56	
premiums	666 09	
races	490 00	
Total		1,798 68
Net profit, 1874		$539 72

This review furnishes us with data upon which to base estimates for the ensuing year. With proper care in keeping your accounts you may soon be enabled to judge with tolerable accuracy of your resources and liabilities in each department, thus enabling you to lop off any unprofitable member, and put you in a position to place a new project whenever the time comes calling for such a movement.

I submit estimates for the year 1875, to-wit:

RESOURCES.

Rent of grounds	$400 00	
Entrance to races, with purse the same as now	250 00	
Proceeds of sale of tickets	1,800 00	
Total		$2,450 00

LIABILITIES.

Expenses	$700 00	
Premiums	700 00	
Races	500 00	
Interest on mortgage	100 00	
Total		2,000 00
Balance		$450 00

RESUME.

Land cost	$1,737 33	
Fences cost	545 73	
Track cost	162 10	
Buildings cost	1,070 30	
Total value of property		$3,515 46
Less indebtedness		1,400 00
Leaves property valued at		$2,115 46

with which to secure our certificates of indebtedness over and above those now outstanding.

In addition to the above property account may be added the grand stand, which will inure to the society for their use and benefit, and add a revenue of $200 or more per annum, beginning with the year 1877.

The outlook is not unfavorable to the payment of your debt on maturity. You will please notice that I estimate the profits for 1875 at $450, and assure you at the same time that they were for the year now ending $539 72.

Admitting then that the profits are all required to meet the floating debt, which will then be matured, you will then be called upon to raise $1,000 in two years, which it seems to me you may reasonably expect to do if your prosperity remains undiminished.

I desire to say that it seems to be the determination of the Board of Directors that nothing shall tempt them to hazard the credit of the association; hence the conservatism which has made their certificates of indebtedness pass at par, against the want of confidence which some of our business men have been lavishing upon us at every step, from the conception to the consummation of the Central Fair Association of Hubbardston.

A. D. LUCE,
Secretary.

KALAMAZOO COUNTY.

ANNUAL REPORT OF THE KALAMAZOO COUNTY AGRICULTURAL SOCIETY.

At the annual meeting held at Kalamazoo January 15, 1876, Mr. Frank Little, Secretary of the Society, made the following report:

MR. PRESIDENT—GENTLEMEN:—We have assembled here to-day, at the beginning of the new year, to attempt briefly to recall and note in a somewhat formal manner some of the principal facts and experiences in the history of our Agricultural Society for the past year, and also to lay anew the foundations of an effective work to be accomplished for the year that is just opening before us.

And first, with a devout and fervent gratitude, let us recognize the beneficent acts of a kind Providence, giving thanks to our Heavenly Father for all the mercies and benefits with which he has surrounded us, and for the success that has crowned our efforts for the year just closed.

That the annual fair of the Kalamazoo County Agricultural Society of 1875 was a successful one, comparatively, in all that is really essential, is conceded by all. Its fame has gone abroad, and our achievements as a society have placed us in the first rank of sister organizations in the State. And can we marvel or be astonished at this? Where will you look for a more intelligent and thrifty people than those that inhabit these fertile woodlands and plains? Where will you find a people more richly endowed with enterprise and patriotism, and all the attributes that elevate and tend to make perfect our truer manhood and womanhood? Then, again, it is safe to say that our accommodations and facilities for such an exhibition are unequaled in the State. "National Park," at Kalamazoo, has truly a national reputation, and is well deserving of all that has been said in its praise.

The thanks of this society are due to Mr. Reed, the proprietor of the grounds, for the use of the park upon very favorable terms during the past three years.

It is my pleasure to note an increasing interest in the society that is being taken year by year by the people of the county. I think there is a much better

state of feeling existing among the farmers and their families toward the society and the official management than formerly. There is more liberality on the part of the general public, less fault-finding; and, as I believe, a truer insight into the real spirit and objects of our association, and a laudable disposition on the part of most to forego personal considerations, and to make personal sacrifices, if need be, to secure successful results.

The book of entries for the fair of 1875 clearly indicates a general awakening on the part of the leading agriculturists of the county, and that a commendable spirit of emulation has been engendered, reaching out to the remotest corners of our jurisdiction. The number of exhibitors was much in excess of any previous fair, and every town in the county was fairly represented upon the books of the society. While we have reason to be greatly encouraged by these unmistakable evidences of progress, and a higher appreciation of the objects sought to be accomplished in the maintenance and work of an agricultural society; still, Mr. President, I feel that this is but the mere gleaning of an abundant harvest of possibilities of what should have been accomplished years ago.

Why, sir, within a radius of fifteen miles from this hall we have a population and material resources sufficient to fill National Park to overflowing; and when I think of all this I am amazed at the leanness of display in many of the departments of the exhibition. Especially is this true in the division of live stock. While in the class of horses there has always been a fair exhibit, comparatively, yet there have been few cattle, fewer sheep, less hogs, and almost an entire absence of any general display of poultry. Now, sir, I am free to say that if each individual farmer in this county would but simply do what would cost but a slight effort, and is no more than their duty in this matter, they would roll in upon such a volume of good things that would be perfectly astounding, and there would not be room enough to receive them.

I have thought that some of our good people have practiced hitching up the great two-horse wagon, and coming to the fair with a full load of wives and sons, wives, sons, daughters, and hired servants, and with a comprehensive, cheap "family ticket," going in to see what their more enterprising neighbors have placed upon exhibition, leaving at home, it may be, better animals of all kinds, and products of the household, the dairy and the farm, and that solely to avoid a little trouble and expense perhaps that may be incurred in bringing them to the fair.

Now, Mr. President, I want to ask these people if they think they have discharged their full duty to the society by simply attending its exhibitions? That is well, I grant, and we are grateful to them for doing that; but they are capable of doing so much better, and of promoting the interests of their own association in a degree so much higher and advantageous every way to themselves and to the general advancement of the science of agriculture in the community, that I am constrained to press this subject upon their profound attention.

We have at this day a powerful organization of farmers and persons interested in the business of agriculture, called the Grange,—a tree planted which has taken deep root, and whose branches now spread over the entire continent. I do not intend to discuss the Grange at this time; it had my support and best wishes from the beginning. I am not a member of this honorable order; but its precepts and inculcations are public, and must commend themselves to the judgment and conscience of every intelligent, fair-minded person. Now, I have simply introduced the grange to say that they can advance the interests of our agricultural societies in an almost incalculable degree if they will. The effect

of their coöperation and concert of action in this single matter alone would bring about results truly wonderful. Were I on the "inside" of the outer door of this organization (and perhaps it is my duty to make application to the nearest Grange for admission), had I the pass-word of truth, and could I similate the "grip" of an honest yeoman, I would visit the various granges of the county, and, taking as I do a special interest in the success of our Agricultural Society, would say: Brothers, sisters, while you aim to fulfill the various obligations and achieve those grand results that your order contemplates, I beg of you to stand by and support in every reasonable way your own county society, located in your midst, organized for your benefit, and especially calculated in every way to promote the science and develop the business of agriculture; than which, can any thing be more intensely practical to you, or bring you such immediate and profitable results?

Mr. President, I am conscious that I have already exceeded the limits usually assigned to a merely statistical report; but, as in the language of the illustrious chief magistrate, this is undoubtedly the last time that I shall be called upon to officiate in this capacity, I beg your indulgence, and that of those present, for the latitude taken in the introduction, and will enter at once upon what you have all been waiting patiently for me to come to, a statement of the transactions and business of the society for 1875.

The whole number of entries made in the various departments of the fair was as follows:

Horses	167
Cattle	62
Sheep	64
Swine	30
Poultry	34
Field and garden products	245
Fruits and flowers	254
Household and dairy products	134
Needlework, painting, etc.	157
Furniture, stoves, etc.	44
Carriages, implements, etc.	141
Sports and games (special)	20
Total entries	1,352

Excess over 1874, 190.

In the department of live stock there was a much larger number on exhibition than the entries would seem to indicate, as it is only a single entry for pairs, herds, or pens of animals.

Without attempting to give any description of the fair, I deem it but just to say that the display and excellent order of arrangement in Floral and Art Hall and in Fruit and Vegetable Hall has, in my opinion, seldom or never been surpassed by any exhibition of like character in the State.

And I would here name Mr. Edward Wheeler, a notable gardener of this locality, as being richly entitled to special mention as an exhibitor of the largest and best collection of vegetables that I remember to have ever seen put upon exhibition.

The amount awarded as premiums in the respective divisions was as follows:

Horses—general list	$248 00
Horses—citizens' prizes	490 00
Cattle	150 00
Sheep	74 00
Swine	44 00
Poultry	24 00
Field and garden products	71 50
Fruit and flowers	81 00
Household and dairy	60 25
Needle-work, paintings, etc.	79 25
Furniture, stoves, etc.	47 50
Carriages, implements, etc.	43 00
Sports and games, etc.	11 95
Total of premiums awarded	$1,424 45

Excess over fair of 1874, $90 95.

Statement of the aggregate receipts and expenditures of the fair of 1875:

RECEIPTS.

For advertising in pamphlet	$263 00
For rent of stands	103 00
Citizens' subscriptions	303 00
Membership tickets	322 00
Gate tickets, adults and children	1,693 90
Grand stand tickets	118 20
Entrance, citizens' prizes, etc.	231 50
Collected by watchman	1 75
Total receipts	$3,036 35

DISBURSEMENTS.

Paid contingent expenses	$1,065 65
premium checks	1,387 00
D. C. Reed	279 35
Balance cash	304 44
Total disbursements and balance	$3,036 25

Condition of the treasury Jan. 15, 1876, cash on hand Jan. 16, 1875	$1,067 35
Balance from fair of 1875	304 44
Total cash balance in treasury Jan. 15, 1876	$1,371 79

The above amount of cash on hand ($1,371 79) at this time represents the surplus earnings, over and above all premiums and expenses of the society for the last three years. I would recommend that the same be invested in the name of the society, as soon as may be convenient, upon good and reliable security.

The incoming board will be called upon to settle definitely some questions of

practice in the management of fairs, upon which at present there are diversities of views.

And here let me say that a convention of officers of agricultural societies of Michigan was held at Kalamazoo, December 9, 1875, which, although not largely attended, was intensely practical and interesting throughout. This convention took under consideration the whole subject of agricultural fairs and their official management. Nearly every topic bearing upon the subject was ably discussed by gentlemen from Berrien, Van Buren, Allegan, Branch and Ingham counties. The convention adopted a number of important recommendations to agricultural societies, all tending to bring about uniformity of action on the part of the county societies of the State, and at the close of the session adopting a permanent form of organization, to be known as "The Association of Agricultural Societies of Michigan." The annual conventions of the association are to be held on the first Wednesday in December in each year. I would recommend that this society be fully represented at the next annual convention.

The question was raised at our last fair as to the propriety of receiving entries and awarding premiums to exhibitors residing out of the county. My own opinion is, that there should be no restrictions of any sort, either as to time or place; that the general list should be absolutely free, the best articles or animals receiving the prize, no matter when made or where they came from. Special classes could be made for all such as stand in fear of outside competition.

Perhaps I ought not to close this report without reference to the fact that this coming year is a memorable one in the history of our country; that it will stand in the calendar as the "Great American Centennial Year of Jubilee." Then, again, it is the year for a general political campaign all along the line for the election of a President and other officers of the general government. It is thought by the philosophers and knowing ones that these two great themes will so perfectly and wholly absorb public attention that all else not immediately connected therewith will be held insignificant and fail for want of support.

Well, how this may be we cannot now say; sometimes the effect of popular excitement is to produce results the very reverse of what was anticipated. If we should hold a county fair and receive twice the patronage that we ever did before, we would all say that these savans were mistaken.

Now, Mr. President, I think I have covered all the ground of a report, and asking pardon for having taken so much time from more important business, will close.

Following the adoption of the above report and the transaction of miscellaneous business, the following officers were elected for the ensuing year:

President—W. H. Cobb.

Secretary—Frank Little.

Treasurer—W. H. McCourtie.

Executive Committee—Chas. E. Morrison, Wm. Bair, Jas. W. Parkhurst, Chas. Ransom.

At a meeting of the officers of the society the time for holding the annual fair for 1876 was fixed to commence Tuesday, September 26th, and to continue four days.

KENT COUNTY.

The following is respectfully submitted:

The twenty-fifth annual exhibition of the Kent County Agricultural Society was held on the grounds belonging to the society at Grand Rapids, on September 28, 29, and 30, and October 1st, 1875.

The number of entries was one thousand seven hundred and ninety-two, which was eight hundred and eighty-four in excess of 1874. The Grand River Valley Horticultural Society held an exhibition on the grounds of the society at the same time. The above number of entries does not include those of the Horticultural Society.

The grounds belonging to the society are considered the best in the State. They are handsomely situated, and easy of access by street railway and good sidewalks.

The improvements consist of the following: The building at the main entrance, in which the offices are located, is in form a quadrant, size 16x120 feet. Fine Art Hall is in form a Grecian cross, 40x120, 22-feet posts. Height of dome 82 feet. A gallery extends around the inside of the building. Length of gallery 480 feet. Pomological building, 44x120 feet; Manufacturer's Hall, 40x120 feet; Agricultural Hall, 20x120 feet; Old Floral Hall, 24x72 feet; Mechanics' Hall, 40x200 feet; 2 carriage sheds, each 24x108 feet; Poultry Hall, 24x100 feet; 2 sheep and swine sheds, each 24x100 feet; 2 grand stands, one 24x180, the other 24x70 feet; over 600 stalls for horses and cattle. The horse stalls are all boxed. The track is one half mile, and equal to any in the west. There are 13 wells upon the ground. The supply of water is ample, and of superior quality. A first-class windmill was erected last summer.

Officers for the ensuing year: President—Aaron Brewer; Secretary—James Cox; Treasurer—F. W. Foster.

Executive Committee—H. G. Holt, A. R. Hoag, Asa W. Meech, Levi Averill, G. W. Chadwick.

JAMES COX, *Secretary.*

MACOMB COUNTY.

Armada Agricultural Society was organized by the citizens of Armada, Macomb county, February 22, 1873, with the following officers, viz.: Hon. Chas. Andrews, President; H. H. Spencer, Vice President; J. E. Barringer, Secretary; Chas. A. Lathrop, Treasurer, and eight directors: Geo. W. Phillips, Abner Lemon, W. D. Pettibone, Jas. Crawford, J. F. Jackman, Erastus Day, Jabez Hebblewhite, Amesy Sutton.

The Society leased suitable grounds for holding their annual fairs, fenced the same with a tight board fence six feet high, placed suitable buildings and other fixtures upon the ground and held their first annual fair October 8th, 9th, and 10th, 1873. There were 807 entries made at this fair, and after paying all premiums and other expenses there were left $100 in the hands of the treasurer. The second annual fair was held October 8th, 9th, and 10th, 1874. The num-

ber of entries made were 1,230. The premium list this year was increased $200, and after paying premiums and all indebtedness there were left in the hands of the treasurer $130. The third and last annual fair was held October 8th, 9th and 10th, 1875. The first day of the fair was very rainy and cold. The number of entries made were 1,011, as follows:

Division A—cattle, 69; horses, 140. Division B—sheep, 41; swine, 20; poultry, 42. Division C—farm implements, 45. Division D—domestic manufactures, 260. Division E—fruits, 147; vegetables, 87; flowers, 25; seeds, 60; big things 75. Total 1,011.

The society increased the premium list $200 over last year, and after paying premiums and all indebtedness against the society have a balance of three hundred dollars in the treasurer's hands. We do not, and it is a rule of the society and incorporated in the lease of the grounds, that we shall not offer nor pay any premiums for speed, or allow any horse-racing whatever. We conduct the fair on a liberal plan, our membership tickets being one dollar a year, which admits the holder, his wife and minor children, to free admission and entries during the fair. Single admission tickets twenty-five cents, good for the day. We hold an agricultural fair in the full acceptation of the term, without any agricultural trots or any species of gambling, and have been successful beyond our expectations. We have now pleasant grounds, well fenced, ticket office, two large buildings 30x50 each, floral and vegetable halls well painted, and a sufficient number of pens for sheep and hogs, well covered with good roofs, good wells, etc., with all necessary fixtures for running a successful fair, all paid for; premiums all paid, and $300 in the treasury. We think this will compare favorably with any society of the same age.

The officers at present are:

President—Hon. Chas. Andrews.

Vice President—Gideon Draper.

Secretary—J. E. Barringer.

Treasurer—Chas. A. Lathrop.

Directors—Geo. W. Phillips, W. D. Pettibone, Abner Lemon, Darius Youngs, Jabez Hebblewhite, James Stevens, I. O. Cudworth, H. H. Spencer.

OAKLAND COUNTY.

The twenty-seventh annual meeting for the election of officers was held on the third Tuesday of January, 1875. The following officers were elected:

President—Charles K. Carpenter, Orion.

Secretary—Noah Tyler, Pontiac.

Treasurer—J. J. Green, Pontiac.

Directors—John Loriter, Orion; John H. Smith, Farmington; W. H. Kimball, C. C. McCarty, Pontiac.

Directors holding over for one year—M. E. Crofoot, Pontiac; J. A. Smith, Commerce; D. A. Wright, Austin; J. M. Norton, Avon; Wm. Dumison, Troy.

The society held a horse show on June 1st, 2d, and 3d, at which there was a fine display of horses in all classes.

The receipts of the society for this fair from all sources, including subscription from citizens of Pontiac of $315, was	$1,970 96
Expenditures for same	1,967 00
Net receipts	$3 36

The Board of Directors at their meeting to revise the premium list for the annual exhibition for 1875, reduced the premiums on an average about eight per cent. from those heretofore offered, deeming it prudent to do so on account of the indebtedness of the society heretofore contracted in the purchase of grounds.

The Directors also changed the rule requiring twenty-five cents for each additional entry for members after the first, so as to allow all members to make as many entries as they desire, with no cost except the membership ticket. The single admission ticket system was adopted by the society some years ago requiring twenty-five cents for each person, and the same for each carriage, single or double, going on the grounds after the first day of the fair; children under ten years free.

October 6th, 7th, and 8th was fixed for holding the fair of 1875, but the first day being continuously rainy, the fair was held over the 9th. Considering the weather at the opening, the fair was a grand success, both as to exhibition of articles and as to attendance. The total number of entries was about 1,500, with an unusual fine display of horses, cattle, sheep, and poultry. Of hogs the display was not large, but comprised some very fine stock. In the machinery department there was an exhibition which did credit to the representatives of all classes of agricultural machinery. The exhibition of vegetables was the best ever made in the county. Of fruit, butter, and cheese a good show was made.

The time of holding the fair was so late that the display of flowers was not as good as usual, but the good taste of the ladies of Pontiac more than made up this deficiency by ornamenting the floral hall with paintings and beautiful works of art, which added greatly to the interest of visitors.

Financially the fair was quite satisfactory.

The receipts from gateage	$2,573 98	
From all other sources	867 57	
Total		$3,441 55

EXPENDITURES.

For premiums awarded	$1,169 50	
Premiums in speed class	425 00	
Other expenses of fair	780 58	
Total		$2,375 08
Net income		$1,066 47

From farmers in different parts of the county we learn that the wheat crop, which in May and June seemed almost destroyed by the winter, partially recovered and made about a two-thirds yield of very good quality, while what was sheltered by timber belts gave a good and more than an average crop.

Corn was a fine crop in growth, but on clay and low lands it did not mature well, and in consequence gave an unusual proportion of soft corn, and gives the farmers much trouble in saving the corn in the crib.

Potatoes and the root crop was the best, both in yield and quality, ever raised in the county.

The hay crop was light; the long continued drouth extending through the last three years shortened this crop very much, shortening the growth of red clover even to a degree never before known in this country, but the increased yield of roots enables the farmers to carry the usual amount of stock with but little inconvenience. The use of roots as feed for stock has rapidly increased in popularity within the last few years. The increase in the production of the ruta baga in the northern part of the county within the last three years will reach at least seventy-five per cent. Potatoes, too, are being largely raised for shipment.

SHIAWASSEE COUNTY.

The Shiawassee County Agricultural Association held its sixteenth annual fair on their grounds in Owosso on the 29th and 30th days of September and the 1st day of October last. It was a most successful exhibition, and financially the greatest success of the sixteen.

The leading feature of a successful exhibition, and one which needs the careful attention of those having it in charge, is to have a premium list so equalized between the several classes that no partiality shall be detected by exhibitors or the public. Our premium list is kept thoroughly revised, the officers have the confidence of the exhibitors, and the association gets the liberal support of the people. The following table gives the number of entries in each department, the number of awards in each, and the amount awarded:

DEPARTMENT.	No. Entries.	No. Awards.	Amount.
Horses	412	134	$394 00
Cattle	83	46	122 00
Sheep	29	17	45 00
Swine	22	19	46 00
Poultry	60	26	23 50
Agricultural implements	76	19	28 00
Leather	10	3	7 00
Cabinet	4	2	2 00
Domestic	123	33	32 00
Paintings, photographs, etc.	50	32	34 25
Needlework	124	44	33 25
Flowers	36	21	18 00
Fruit	57	24	30 50
Bread, butter, and cheese	38	11	8 25
Maple sugar, honey, etc.	29	14	7 50
Vegetables	156	34	16 75
Grain, flour and feed	70	27	26 00
Totals	1,379	507	$874 00

The receipts for admission and membership tickets amounted to $1,617.10.

There has been a marked improvement in stock of nearly all kinds, sheep being nearly at a stand-still.

The annual election of officers took place on the fair grounds the last day of the fair, with the following result:

President—C. Hibbard.

Secretary—N. Baldwin.

Treasurer—A. B. Chipman.

Directors—Wm. Newberry, W. G. Manice, E. J. Cook, David Parker.

E. L. BREWER, *Secretary.*

AGRICULTURAL CONVENTION.

A convention of the agricultural societies of western Michigan was held at Kalamazoo Dec. 9th, 1875. The representation of societies was as follows:

Van Buren County—A. C. Glidden, Secretary; Executive Committee—Asa Crofoot, G. D. Boyce, Wm. Markillie, David Woodman.

Berrien County—W. B. Davis, President, Niles, Mich.

Kalamazoo County—W. H. Cobb, Pres't; Frank Little, Sec'y; W. H. McCourtie, Treas.; A. M. Stearns, W. Bair.

Plainwell Union Agricultural and Industrial Society—J. Winchell, Secretary, Plainwell.

Branch County—Hon. C. G. Luce, President, Gilead P. O.

Ingham County—Letter read from Anson F. Wood, President. Mr. L. B. Potter, from the Central Michigan District Agricultural Society, Lansing, was present and represented that organization.

The convention was called to order by Mr. Frank Little, chairman of committee on organization, and after a brief address by that gentleman the following officers of the convention were chosen: Hon. C. G. Luce, President: Frank Little, Secretary.

Mr. Luce, on taking the chair, said the honor was unexpected. He had come up to learn and to communicate any slight knowledge he might possess in regard to the best method of conducting county fairs. We all fully appreciate the embarrassment and difficulties under which the officers of the societies labor. The faithful officer always desires that the fair shall be a success, and questions of what to do and what not to do are frequently arising to perplex him, and this meeting to compare views and impart knowledge one to another meets my hearty approbation. The great question is how to make our fairs *useful* as well as successful. To the proper solution of this question let us devote ourselves. Thanking you for the honor conferred, I assume the duties of the chair.

The convention took a recess until half-past 1 p. m.

AFTERNOON SESSION.

On motion of Mr. Little, the topics suggested in the call were adopted as the order of business.

First topic: Rules and Regulations.

Mr. Glidden suggested that the rules of each society be read for comparison and interchanging views. Adopted.

Membership tickets.—Three societies reported that they gave five tickets with membership ticket, the other five only four.

Mr. Potter moved that this convention recommend that four tickets be given with the membership ticket. Adopted.

Mr. Little moved that this convention recommend that adult tickets be fixed at a uniform price of twenty-five cents. Carried.

Mr. Davis said that at Berrien they had much trouble about teams entered claiming free admission. They had adopted the Kalamazoo rules, charging admission after 9 o'clock A. M.

Mr. Potter moved that the convention approve of the rules of the Kalamazoo Society in reference to teams entered for exhibition, that they be charged admission after 9 o'clock A. M. Adopted.

Mr. Glidden moved that firms exhibiting at fairs be treated as a unit. Adopted.

Mr. Potter thought competition ought to be open to the State even.

Mr. Stearns moved that the convention recommend that premium lists of county societies be open to all other counties. Adopted.

Mr. Stearns moved that Kalamazoo rules be adopted, that "animals or articles can only compete for one premium, except for special and sweepstake premiums." Adopted.

Mr. Potter moved that the convention recommend that premium badges be affixed on the last day of the fair by the superintendents. Lost.

It was moved that articles and animals without competition be awarded 1st and 2d premiums if worthy. Adopted.

The second topic, "General Management of Fairs," was then taken up and discussed. Mr. Winchell moved that all unlawful amusements be excluded from the fair ground, including intoxicating drinks. This led to an extended interchange of views, and incidentally the subject of horse-racing was brought in. Mr. Potter, of Lansing, said that under the motion trials of speed would have to be excluded, as the statute recognized horse-racing as unlawful. He gave extracts from the law, showing that supervisors were not permitted to give aid to fairs which allowed or encouraged betting and horse-racing.

Mr. Winchell said he did not mean to prohibit trials of speed. He did not think a horse trot or a trial of speed under proper regulations was unlawful or wrong in any respect.

Mr. Davis of Berrien was in favor of trials of speed, and made some good talk on the subject.

The speakers all seemed to agree upon the point that all games of chance and all devices of a gambling character, and the sale of intoxicating drinks should be prohibited upon the grounds, and Mr. Winchell's motion was unanimously adopted, it being tacitly admitted that trials of speed under proper restrictions and conduct were not an unlawful amusement.

The subject of amusements was further discussed in respect to the matter of offering special attractions to "draw the crowd." Mr. Stearns thought it not objectionable, not inimical to the purpose and success of county fairs, to make them attractive to the multitude, and was in favor of introducing features of popular interest. He related the success which had attended the efforts of our own fair in this respect. He did not sympathize with that feeling which prevailed with some, that it is unworthy to resort to extraneous aids to make agricultural

fairs a pecuniary success, and who thought that special features detracted from the great object of the yearly meetings. The speaker said: "Church societies and other institutions recognized the necessity of making their services attractive by getting the most popular speakers, the best of choirs, and making the interior as attractive as possible."

Mr. Winchell was opposed to the employment of speakers at county fairs merely for notoriety. He alluded to such speakers as "Brick" Pomeroy, Gen. Butler, and others, who were merely used to draw the crowd. Reasonable and decorous amusements or special features he was not opposed to, and believed that they might be advantageously used.

Mr. Woodman was in favor of an annual address, and referred to the fact that the address of Schuyler Colfax at Paw Paw last fall was a large source of interest and profit. Mr. Woodman was, however, rather conservative on the subject of amusements, and both he and Mr. Glidden averred that the exclusion of trials of speed in their county fair had been for the best interest of their society.

Mr. Davis was emphatic for amusements. He believed that the people want relaxation and diversion. He had but little patience with those moralists who expected all people to move in a straight and narrow line. He indulged in some extended remarks upon the amusement question, even going into the subject of amusements for our sons and daughters. He said if we do not take the pains to furnish amusement for our children they will go in pursuit of it, and perhaps find the very worst sort. Mr. Davis related what had been done for his society in respect to what might be called "outside features," and they had worked well. He believed in making the annual meetings of the farmers a matter of interest to all,—a holiday for farmer, mechanic, laboring man,—for all classes, old and young.

Mr. Luce spoke of the success of the Hillsdale county fair, which, in his opinion, is a model in every respect, the most successful of all the county fairs in the State. There nothing is done of an *ad captandum* nature. It is an agricultural fair, pure and simple, but the people of the county, all classes, seem to make it their fair, and on the last two days of the annual meeting the county seems to turn out *en masse*. The merchant is there with his wares; the mechanic brings out the best products of his skill; the stock-raisers, the butter-makers, the gardeners and others select their finest and fattest, and exhibit them; the ministers are there to pray, the lawyers lay aside their business, the professional men and the unprofessional, the young and the old, all come, feeling that it is their fair, and it is a grand gala day for all. Mr. Luce said that there had sprung up in that county a smart competition in nearly all kinds of products, especially stock-raising, which has enlisted the attention of the whole community. In respect to an annual address, he was in favor of them, but they must be brief, and should be made by such speakers as could interest and dignify the occasion. He was not opposed to the use of attractions to make the fairs pecuniarily successful.

After remarks by Mr. Little and others, Mr. Stearns moved that innocent amusements might properly be encouraged at county fairs.

The next topic was "Speed Premiums." The discussion here took an extended range, and we regret we have not space to give a more full abstract of the discussions on this and on the other topics, for this talk was good, and showed that much thought had been bestowed upon it as the result of long experience. Mr. Little stated that the feeling among the farmers in this county

was against speed premiums being paid, and explained that the purses given at our county fair were special ones raised by the people of the village and denominated "citizens' premiums." The prevalent idea among the members present was that small premiums for trials of speed should be given. The improvement of the breed and stock of horses was worthy of all encouragement. The idea was urged that there was no more sin in the trial of speed than in a trial of strength, and no one seemed to be shocked at the exhibition of the powers of the draft horse. There were various kinds of horses desirable. Some would take a horse for a roadster, some for style, as carriage horses, etc., and this was a source of profit to the farmer and producer.

Mr. Winchell finally moved the following, which was adopted:

Resolved, That whereas the breeding of fine driving horses is a profitable branch of husbandry, it is within the legitimate province of the agricultural societies to encourage the proper competition of such stock by offering reasonable speed premiums.

Fourth topic, "Special Premiums," passed without discussion.

Fifth, "Agricultural Societies," general topic.

Suspended topics until 7 P. M.

Report on permanent organization taken up. Mr. Little submitted the following report:

This Association shall be called "The Association of Agricultural Societies of Michigan."

Its officers shall consist of a President, Vice-President, Secretary and Treasurer, and an Executive Board of Directors, consisting of the Presidents of all the societies belonging to the Association, or such other persons as the societies may elect, which officers and directors shall perform such duties as usually pertain to such positions. They shall be elected annually by ballot, and hold their office until their successors are chosen.

The object of this association shall be, so far as may be desirable, to establish a uniformity of management of fairs; the adoption of such general rules and regulations as may best subserve the interests of the various societies belonging to the association, and the discussion of such topics at its annual conventions as the exigencies and the interests of agriculture may require.

This association is intended to embrace all the agricultural societies of the State.

The annual conventions of the association shall be held on the first Wednesday in December of each year, at such place as the next preceding convention shall have determined, due notice of which shall be forwarded by the secretary to the secretary of each agricultural society belonging. Special meetings may be called at any time at the request of a majority of the entire board of officers. Adopted.

ELECTION OF OFFICERS.

First ballot for President—A. C. Glidden received 4 votes, C. G. Luce 3, L. B. Potter 1, Frank Little 1.

Second ballot—Glidden 5, Luce 4, Potter 1.

Third ballot—Glidden 4, Davis 4, Potter 1.

Fourth ballot—Glidden 6, Davis 2, Little 2, Luce 1.

Glidden was declared elected.

Frank Little was unanimously chosen as Secretary and Treasurer of the association.

Mr. L. B. Potter, of Lansing, was chosen Vice-President of the association. Convention then adjourned until 7 P. M.

EVENING SESSION.

Called to order by the President.

Resumption of topic No. 5, "Agricultural Societies," general topic.

President Luce said that the benefits to be derived from these organizations are conceded to be beyond all question. They exert a large influence in promoting the agricultural interests of the country.

Remarks were also made by Mr. Potter, Mr. Cameron, Mr. Little, Mr. Stearns, and Mr. Markillie.

6th Topic, "Time of holding county fairs." Mr. Potter thought the first week in October was as good or better than any week preceding, on account of weather, etc., yet wished that the State fair could be fixed later in the season. This seemed to be the prevalent idea with the speakers. The idea that the State fair should hold its annual meeting later than now, indeed *after* the county fairs instead of *before* them, letting the little meetings all contribute to the big ones, was strongly urged, and all the bearings of the subject given. The fact that the State fair came before all the county fairs, it was urged, was injurious to the success of the latter.

7th Topic, "Objects in farming needing special encouragement." Mr. Glidden thought premiums on sheep ought to be increased. Mr. Stearns thought the production of hay ought to be encouraged.

Some time was spent in the relation of experiences in regard to the conduct of fairs. Mr. Potter thought that the premium lists should be gotten out earlier, and that the secretary should have more time to make the entries. Mr. Little, Mr. Glidden, Mr. Luce, and some others explained their systems. The plan was found to work well to give general publicity to the premium list which is issued in June in pamphlet form, and as the time of the fair approaches to get in as many entries as possible before the opening day of the fair, keeping the books open till the afternoon of the second day. Then, with proper assistance, the books for the committees could be prepared in time.

Mr. Little said the press of this county had been very liberal in placing all items in regard to the fair before the public, and in making an interest in the society widely felt.

After much other talk upon questions connected with subjects before the convention, Mr. Glidden moved that the convention adjourn to meet on the first Wednesday in December, the place to be fixed by the president and secretary. Carried, and the convention adjourned.

REGISTER OF

METEOROLOGICAL OBSERVATIONS

FOR THE YEAR 1875.

TAKEN AT THE

State Agricultural College of Michigan,

BY R. C. KEDZIE,

PROFESSOR OF CHEMISTRY.

LATITUDE 42° 42′ 24″; LONGITUDE 7° 33′ 19″ WEST OF WASHINGTON.
Height above the Sea, 895 feet.

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in Open Air. 7 A. M.	2 P. M.	9 P. M.	Daily Mean.	Pressure of Vapor, in Inches. 7 A. M.	2 P. M.	9 P. M.	Relative Humidity, or Percentage of Saturation. 7 A. M.	2 P. M.	9 P. M.	Barometer Reduced to Freezing Point. 7 A. M.	2 P. M.	9 P. M.	Mean.
1	18	30	26	26	.082	.130	.141	84	78	100	29.273	29.060	28.912	29.082
2	27	22	15	21⅓	.147	.118	.086	100	100	100	28.623	28.877	28.985	28.825
3	15	20	10	15	.086	.108	.054	100	100	78	29.000	28.988	29.003	28.997
4	10	16	10	12	.068	.059	.068	100	65	100	29.016	29.038	29.060	29.038
5	1	7	1	3	.046	.045	.046	100	76	100	29.101	29.178	29.253	29.177
6	2	8	-1	3	.048	.034	.042	100	54	100	29.203	29.181	29.153	29.179
7	-2	16	-1	4⅓	.040	.074	.042	100	83	100	29.131	28.993	29.036	29.053
8	8	18	15	13⅔	.048	.067	.086	77	68	100	29.046	28.893	28.770	28.923
9	-7	-6	-13	-8⅔	.032	.033	.025	100	100	100	28.992	29.110	29.180	29.094
10	-11	9	-1	1	.027	.051	.042	100	77	100	29.208	29.104	29.084	29.132
11	2	16	8	8⅔	.048	.059	.062	100	65	100	29.092	29.171	29.336	29.199
12	5	22	18	15	.041	.084	.098	74	71	100	29.161	28.981	28.818	28.986
13	19	25	18	17⅓	.087	.117	.082	84	84	84	28.615	28.743	28.918	28.758
14	8	10	-4	4⅔	.048	.054	.036	77	78	100	29.096	29.123	29.213	29.147
15	-7	8	8	3	.032	.048	.048	100	77	77	29.292	29.201	29.103	29.198
16	8	16	9	7⅔	.062	.059	.036	100	65	56	29.013	29.081	29.231	29.108
17	7	17	11	11⅔	.045	.063	.071	76	67	100	29.336	29.291	29.215	29.281
18	8	19	12	13	.062	.071	.075	100	63	100	29.095	29.098	29.137	29.110
19	5	17	3	8⅓	.055	.063	.050	100	67	100	29.181	29.178	29.181	29.180
20	6	15	14	11⅔	.057	.055	.082	100	64	100	29.211	29.166	29.003	29.126
21	21	32	29	27⅓	.080	.125	.160	71	69	100	28.893	28.701	28.666	28.753
22	15	19	8	17⅓	.070	.071	.062	82	69	100	28.818	28.928	29.123	28.956
23	-6	27	24	15	.033	.093	.129	100	63	100	29.168	29.133	29.038	29.113
24	21	30	20	23⅔	.113	.130	.091	100	78	85	28.696	28.658	28.813	28.722
25	9	17	10	12	.065	.063	.068	100	67	100	29.038	29.138	29.228	29.131
26	8	19	16	14⅓	.062	.103	.090	100	100	100	29.310	29.253	29.148	29.237
27	25	35	33	31⅔	.117	.142	.188	87	70	100	29.918	28.755	28.737	28.800
28	27	26	7	20	.147	.088	.060	100	62	100	28.755	28.720	28.775	28.750
29	7	29	13	16⅓	.060	.105	.078	100	66	100	28.765	28.617	28.568	28.650
30	16	17	12	15	.090	.078	.075	100	83	100	28.558	28.695	28.658	28.637
31	11	17	12	13⅓	.071	.063	.075	100	67	100	28.740	28.788	28.880	28.803
Sums.	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	......	......	......	12°.87	.067	.079	.076	94	74	96	......	......	......	29.005
Average	......				.074			88			......			

THE MONTH OF JANUARY, 1875.

CLOUDS.						WINDS.						OZONE.		REGIST'RING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
30	St.	60	Cu. St.	100	Nim.	....	0	S	1	S E	2	3	2	34	16	7 P. M.	......	......	...
100	Nim.	100	Nim.	00	....	S W	4	S W	4	S W	2	8	8	30	13	......	......	......	...
100	Nim.	100	Nim.	00	....	S W	1	W	1	W	2	5	3	22	6	......	......	......	...
100	Nim.	100	Cu. St.	100	Nim.	....	0	N W	2	S	2	6	4	16	0	......	......	......	...
100	St.	60	Cu.	100	St.	S W	3	S W	2	S E	3	3	7	9	2	......	6 A. M.	.082	...
100	Nim.	40	Cu.	....	....	S E	2	W	1	....	0	4	6	10	-10	......	......	......	...
100	St.	100	St.	00	....	....	0	....	0	....	0	5	2	17	-2	......	......	......	...
100	St.	100	St.	100	Nim.	....	0	S E	3	S E	3	6	3	20	-9	7 P. M.	......	......	...
100	Nim.	100	Nim.	00	....	W	5	W	5	S W	5	6	7	-6	-13	......	3 P. M.	.019	...
80	Cir. Cu.	00	....	00	....	S W	4	S W	1	S W	2	4	8	9	-11	......	......	......	...
100	Cu. St.	40	Cu.	100	Cu. St.	S W	1	W	1	....	0	3	4	17	0	......	......	......	...
10	St.	60	Cir. St.	100	Nim.	E	1	N E	2	S E	1	5	7	21	17	6 P. M.	......	......	...
100	Nim.	100	Nim.	100	Cu. St.	S W	1	W	3	W	5	6	8	25	6	......	12 M.	.274	3
100	Nim.	100	Cu. St.	00	....	S W	3	N W	3	....	0	8	1	10	-8	......	......	......	...
100	St.	100	Cu. St.	100	Cir. St.	....	0	S E	1	E	2	7	7	8	-7	......	......	......	...
100	Cir. St.	100	Nim.	90	Cir. Cu.	....	0	N W	2	N W	3	6	7	16	6	......	......	......	...
90	Cu. St.	90	Cir. Cu	100	Nim.	....	0	S W	2	....	0	8	3	17	5	9 P. M.	......	......	...
100	Nim.	30	Cu.	100	Nim.	....	0	W	2	S W	2	4	6	20	7	......	7 P. M.	.236	...
100	St.	30	Cu.	100	Cu. St.	....	0	S W	1	....	0	3	6	17	1	......	......	......	...
100	St.	100	St.	100	Cu. St.	....	0	S E	2	S E	3	6	9	17	5	......	......	......	...
100	Cu. St.	100	Cu. St.	100	Nim.	....	0	....	0	....	0	6	7	32	14	......	......	......	...
90	Cu. St.	30	Cu.	00	....	W	5	W	4	....	0	6	2	20	-11	......	......	......	...
30	St.	60	Cir. St.	100	St.	....	0	E	2	E	3	7	9	27	-6	......	......	......	...
100	Nim.	100	Cu. St.	100	Cu. St.	S	1	S W	3	S W	5	7	10	30	9	7 A. M.	3 P. M.	.234	...
40	Cir. St.	70	Cu.	100	Cu. St.	S W	3	W	2	N W	2	7	8	18	6	......	......	......	...
100	St.	70	Cir. St.	100	St.	....	0	S W	1	S E	2	5	8	22	7	......	......	......	...
100	St.	100	Nim.	100	Nim.	S	2	S	1	....	0	7	2	35	24	8 A. M.	......	......	...
100	Nim.	20	Cir.	00	....	N W	2	....	0	....	0	5	4	27	-4	......	9 A. M.	.31	3
100	Nim.	40	Cu.	100	Nim.	....	0	S W	1	S E	1	4	9	30	5	7 A. M.	......	......	...
100	Nim.	100	Cu. St.	100	Nim.	S W	3	S W	5	N E	2	5	8	17	10	......	12 M.	.08	1½
00	....	10	Cu.	100	Cu. St.	N W	2	N W	2	....	0	6	7	17	-2	......	Night	.974	1½
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	1.809	9
86	....	71	....	71	....	....	..	....	..	....	..	5.52	5.93	19.°48	2.°41	......	......	......	...
		76																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in Open Air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	1	24	18	14⅓	.046	.161	.069	100	47	100	28.838	28.803	28.920	28.853
2	20	31	35	28⅔	.075	.174	.183	70	100	90	28.928	28.767	28.582	28.759
3	32	2	1	11⅔	.181	.048	.046	100	100	100	28.172	28.350	28.551	28.357
4	-7	3	-4	-2⅔	.032	.036	.036	100	72	100	28.779	28.887	29.146	28.934
5	-5	10	16	7	.035	.054	.090	100	78	100	29.292	29.141	29.021	29.151
6	16	4	-8	4	.090	.038	.031	100	73	100	29.312	29.403	29.381	29.365
7	-28	13	-1	-5⅓	.013	.075	.042	100	100	100	29.231	29.052	28.901	29.061
8	-8	1	-12	-6⅓	.031	.046	.026	100	100	100	28.867	28.907	29.025	28.933
9	-32	0	-15	-15⅔	.011	.030	.023	100	69	100	29.240	29.320	29.333	29.299
10	4	9	18	10⅓	.052	.065	.097	100	100	100	28.857	28.701	28.476	28.678
11	14	4	-3	5	.082	.052	.038	100	100	100	28.564	28.776	28.851	28.730
12	-13	4	-10	-6⅓	.025	.038	.028	100	73	100	28.912	28.867	28.887	28.888
13	-12	16	0	1⅓	.026	.059	.044	100	65	100	28.927	28.901	28.924	28.917
14	-18	6	-6	-6	.020	.057	.033	100	100	100	29.042	29.087	29.137	29.088
15	-17	9	1	-2⅓	.094	.036	.046	100	56	100	29.187	29.177	29.174	29.179
16	-13	14	10	3⅓	.025	.067	.068	100	81	100	29.170	29.087	28.894	29.050
17	1	15	-1	5	.056	.055	.042	100	64	100	28.944	29.094	29.156	29.064
18	-26	17	15	2	.014	.094	.096	100	100	100	29.215	28.883	28.766	28.954
19	12	25	20	19	.075	.135	.108	100	100	100	28.534	28.458	28.383	28.458
20	16	22	14	17⅓	.090	.118	.082	100	100	100	28.358	28.360	28.560	28.426
21	-14	24	4	4⅔	.014	.118	.052	100	100	100	28.821	28.890	28.968	28.893
22	20	42	37	33	.108	.244	.221	100	91	100	28.880	28.606	28.707	28.731
23	24	28	29	33⅔	.129	.153	.160	100	100	100	28.802	28.700	28.525	28.675
24	33	37	29	33	.188	.199	.160	100	90	100	28.458	28.637	28.752	28.615
25	18	25	20	21	.098	.117	.108	100	87	100	28.616	28.606	28.710	28.644
26	12	19	14	15	.075	.071	.082	100	69	100	28.840	28.843	28.853	28.845
27	-3	15	3	5	.038	.040	.050	100	46	100	28.833	28.838	28.981	28.884
28	-5	11	6	4	.035	.057	.057	100	79	100	29.177	29.091	28.951	29.073
Sums.														
Means				7.°99	.063	.087	.075	99	83	99				28.875
Average					.075			94						

THE MONTH OF FEBRUARY, 1875.

CLOUDS.						WINDS.						OZONE.		REGIST'RING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		9 P. M.		2 P M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
00	....	00	....	00	....	s w	4	s w	5	....	0	3	8	25	1	......	......	.....	....
100	Cu. St.	100	Nim.	100	Cu. St.	....	0	s E	1	s E	4	6	10	36	19	......	......	.....	....
100	Cu. St.	90	St.	100	Cu. St.	s w	6	s w	6	s w	6	8	9	31	-8	......	......	.....	....
10	Cir. Cu.	30	Cu.	00	....	s w	6	s w	6	s w	5	7	3	5	-8	11 A M	12 M.	.10	1½
00	....	100	Cir. Cu.	100	Nim.	s w	2	s w	5	s w	3	6	9	16	-5	8 P. M.	Night	.30	1½
90	St.	30	Cu. St.	00	....	....	0	....	0	....	0	7	1	16	-31	......	......	.....	....
00	....	10	Cu. St.	00	....	....	0	s w	2	s w	3	5	9	13	-28	......	......	.....	....
80	Cu. St.	40	Cu.	0	....	....	0	N W	3	N W	2	2	8	3	-33	......	......	.....	....
00	....	00	....	00	....	....	0	s w	1	....	0	8	8	4	-20	......	......	.....	....
100	Cu. St.	100	Nim.	100	Nim.	s w	5	....	0	s E	2	6	7	20	0	8 A. M.	......	.....	....
100	Nim.	100	Nim.	100	Nim.	s w	5	s w	6	s w	5	5	8	14	-14	......	10 P M	.50	6
20	St.	10	St.	10	Cir.	s w	3	N W	3	N W	1	4	7	4	-15	......	......	.....	....
5	St.	50	Cir. Cu	0	....	s w	1	N W	3	....	0	7	2	17	-25	......	......	.....	....
00	....	00	....	00	....	....	0	N W	2	N W	1	6	2	8	-21	......	......	.....	....
00	....	00	....	90	Cu.	....	0	N W	3	....	0	5	6	11	-14	......	......	.....	....
00	....	00	....	100	Nim.	s w	1	s w	3	s w	4	5	8	14	-13	8 P. M.	Night	.05	1
00	....	5	Cu.	00	....	s w	3	s w	1	s w	1	7	7	15	-27	......	......	.....	....
00	....	90	Cu. St.	100	Cu. St.	s w	1	s w	2	s E	3	6	8	17	-26	Night	......	.....	....
100	Nim.	100	Nim.	100	Nim.	s E	1	....	0	....	0	7	4	25	12	......	......	.....	....
100	Nim.	100	Nim.	100	Cu. St.	s w	1	s w	2	s w	3	4	5	22	-16	......	8 P. M.	.08	1½
80	St.	00	....	00	....	....	0	....	0	....	0	4	3	24	-14	......	......	.....	....
90	Cu. St.	100	Nim.	100	Nim.	s E	2	s E	4	....	0	9	10	42	20	11 A M	......	.....	....
100	Nim.	100	Cu. St.	100	Cu. St.	....	0	N E	3	s	2	8	6	30	24	......	8 A. M.	.33	....
100	Nim.	100	Cu. St.	100	Cu. St.	s w	3	....	0	....	0	5	9	39	17	7 A. M.	......	.....	....
100	Nim.	100	Cu. St.	30	Cu. St.	....	0	s w	5	s w	5	4	6	25	10	......	10 A M	.438	....
100	Nim.	100	Cu. St.	100	Cu. St.	N W	2	....	0	....	0	7	4	21	-6	Night	11 A M	.10	2
00	....	90	Cu. St.	00	....	s w	3	s w	5	s w	2	7	7	19	-11	......	......	.....	....
00	....	100	Cu. St.	100	Nim.	....	0	N E	2	N E	3	4	10	12	-5	4 P. M.	......	.30	4
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	.....	....
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	.....	....
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	.....	....
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	2.198	17½
49	....	58	....	51	....	....	..	....	..	....	..	5.78	6.57	22.°39	-8.°10	......	......	.....	....
		53																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	7	12	7	8⅔	.060	.075	.060	100	100	100	28.613	28.496	28.633	28.581
2	7	20	9	12	.060	.075	.065	100	70	100	28.907	29.036	29.111	29.018
3	5	10	11	8⅔	.055	.068	.071	100	100	100	28.971	28.701	28.960	28.877
4	12	25	17	18	.075	.100	.078	100	74	83	29.114	29.118	29.029	29,087
5	20	30	24	24⅔	.091	.130	.129	85	78	100	28.858	28.767	28.707	28.777
6	18	29	21	22⅔	.098	.142	.096	100	88	85	28.851	28.921	28.927	28.890
7	24	30	17	23⅔	.111	.130	.094	86	78	100	28.870	28.648	28.788	28.768
8	-3	34	15	15⅓	.033	.155	.086	100	79	100	28.938	28.951	28.950	28.946
9	22	37	25	28	.118	.199	.135	100	90	100	28.818	28.663	28.700	28.727
10	27	32	26	28⅓	.129	.162	.123	83	89	87	28.711	28.716	28.790	28.739
11	22	33	33	29⅓	.118	.188	.168	100	100	89	28.777	28.375	28.503	28.552
12	23	43	30	32	.123	.121	.111	100	43	67	28.831	28.876	28.773	28.826
13	27	44	39	36⅔	.147	.196	.195	100	68	82	28.703	28.718	28.715	28.712
14	42	53	35	43⅓	.222	.244	.204	83	60	100	28.551	28.418	28.399	28.456
15	35	50	29	38	.212	.335	.160	100	93	100	28.191	27,980	28.152	28.107
16	16	19	11	15⅓	.074	.087	.071	83	84	100	28.238	28.330	28.428	28.332
17	6	13	9	9⅓	.057	.063	.065	100	81	100	28.646	28.849	28.982	28.825
18	3	21	13	12⅓	.050	.096	.078	100	85	100	29.199	29.193	29.195	29.195
19	8	21	11	13⅓	.062	.080	.071	100	71	100	29.172	29.081	28.973	29.075
20	11	24	11	15⅓	.071	.094	.071	100	73	100	28.778	28.751	28.863	28.797
21	11	27	11	16⅓	.071	.111	.071	100	75	100	29.023	29.068	29.102	29.064
22	-8	32	14	12⅔	.031	.125	.082	100	69	100	29,203	29.204	29.211	29.206
23	15	30	31	25⅓	.086	.148	.174	100	89	100	29 154	28.957	28.641	28.917
24	32	29	20	27	.143	.142	.108	79	88	100	28.754	28.948	29.088	28.930
25	11	35	34	26⅔	.071	.127	.196	100	62	100	29.211	29.161	28.888	29.086
26	36	44	35	38⅓	.212	.241	.142	100	84	70	28.618	28.632	28.670	28.640
27	36	40	26	34	.170	.139	.141	80	56	100	28.834	28.940	29.090	28.954
28	27	37	31	31⅔	.129	.157	.136	88	71	78	29.178	29.130	29.053	29.120
29	27	53	44	41⅓	.111	.194	.196	75	48	68	29.041	28.987	29.012	29.013
30	44	64	57	55	.241	.403	.407	84	67	87	28.995	28.937	28.940	28.957
31	55	73	58	62	.321	.376	.483	74	47	100	28.882	28.781	28.739	28.801
Sums	.....	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	.....	......	......	26°.2	.111	.160	.137	93	76	93	....	....	....	28.844
Average						.136			87		....			

THE MONTH OF MARCH, 1875.

CLOUDS.						WINDS.						OZONE.		REGIST'RING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Nim.	100	Nim.	50	Cir.	N E	4	N E	4	N	3	8	7	13	5	......	......	....	....
100	Nim.	100	Cu. St.	00	....	N W	1	N	1	....	0	8	3	21	-7	......	8 A. M.	....	12
100	Cu. St.	100	Nim.	00	....	N E	3	N E	5	....	0	7	9	12	4	12 M.	7 P. M.	....	4
100	Nim.	00	....	10	St.	....	0	S W	1	N W	2	5	9	27	10	Night	......	....	....
100	Nim.	100	Nim.	100	Nim.	E	1	E	1	....	0	4	8	30	8	......	Night	.14	2
100	Cu. St.	100	Cu. St.	00	....	....	0	N E	1	....	0	5	3	30	16	......	......	....	....
7	St.	40	Cu.	00	....	N	2	N E	2	....	0	4	6	34	-5	......	......	....	....
5	St.	10	Cu.	00	....	....	0	....	0	....	0	5	8	36	-3	......	......	....	....
100	Cu. St.	100	Cu. St.	100	Nim.	S E	2	....	0	S W	2	7	10	39	22	3 P. M.	......	....	....
100	Cu. St.	100	Cu. St.	30	Cu. St.	S W	2	S W	3	....	0	3	5	35	14	......	Night	.03	....
100	Cu. St.	100	Nim.	100	Cu. St.	S	2	S E	3	S W	4	10	6	37	20	9 A. M.	8 P. M.	.05	....
20	Cu. St.	00	....	80	Cir. Cu.	....	0	....	0	N E	2	4	3	43	25	In Night	......	.03	½
90	Cu. St.	00	....	40	Cir. Cu.	E	2	W	1	S W	2	8	5	46	27	......	......	....	....
00	....	40	Cu.	100	Nim.	....	0	S E	2	N W	4	6	3	54	33	Thun. showr	......	.02	....
100	Cu. St.	90	Cu. St.	100	Nim.	....	0	S E	1	S W	6	7	7	54	15	......	......	....	....
60	Cir. Cu.	100	Nim.	100	Cu. St.	S W	7	S W	7	S W	5	8	8	20	5	......	......	....	....
20	Cu.	40	Cu.	30	Cu.	W	4	N W	3	S W	1	8	5	13	0	......	......	....	....
10	Cir.	80	Cu. St.	100	Cu. St.	....	0	S W	2	S W	1	5	8	23	3	......	......	....	....
100	Cu. St.	100	Cu. St.	100	Nim.	N E	2	N E	2	N E	2	8	7	24	7	7 P. M.	......	....	....
100	Cu. St.	100	Cu. St.	100	Nim.	N E	3	N E	3	N	1	9	9	25	-6	......	2 P. M.	.20	3
10	Cir.	00	....	30	Cir.	N	2	N	1	....	0	4	4	27	-11	......	......	....	....
00	....	00	....	00	....	....	0	....	0	....	0	5	4	34	-8	......	......	....	....
10	Cir.	100	Cu. St.	100	Nim.	S E	2	S E	3	S E	3	3	8	32	12	6 P. M.	Night	.11	2
90	Cir. Cu.	100	Cu. St.	00	....	S W	1	S W	4	....	0	7	3	34	3	......	......	....	....
20	Cir. St.	100	Cu. St.	100	Cu. St.	....	0	S	1	S W	2	4	7	40	9	Night	......	....	....
100	Nim.	00	....	00	....	S W	2	S W	3	S W	3	5	5	44	32	......	9 A. M.	.26	....
00	....	00	....	00	....	S W	3	S W	3	....	0	4	6	43	19	......	......	....	....
100	Cu. St.	10	Cir.	00	....	S E	2	S W	1	....	0	3	3	39	22	......	......	....	....
00	....	90	Cir. St.	00	....	S W	1	S W	2	....	0	4	7	54	27	......	......	....	....
100	Cu. St.	70	Cir Cu.	00	....	S E	2	S E	2	S E	3	6	7	64	42	......	......	....	....
20	Cir.	90	Cu. St.	100	Nim.	S E	2	S E	3	S E	2	3	9	75	54	4 P. M.	......	.18	....
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	1.02	23½
60	....	47	....	41	....	....	..	....	..	....	..	5.70	6.19	35°.54	12°.71	......	......	....	....
		49																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	57	45	33	45 .	.436	.182	.116	94	61	53	28.939	29.050	29.158	29.049
2	33	40	28	33⅔	.131	.203	.135	70	82	88	29.205	29.161	29.132	29.166
3	34	53	47	44⅔	.155	.219	.202	79	54	62	29.070	28.937	29.094	29.034
4	40	53	38	43⅔	.203	.219	.168	82	54	81	29.176	29.152	29.341	29.223
5	34	55	43	44	.175	.243	.186	89	56	67	29.483	29.130	29.376	29.329
6	44	72	51	55⅔	.196	.460	.348	68	83	93	29.268	29.182	29.209	29.219
7	39	66	46	50⅓	.195	.407	.286	82	63	92	29.249	29.212	29.175	29.212
8	44	73	68	61⅔	.241	.376	.380	48	47	56	29.131	28.972	28.871	28.991
9	45	53	40	46	.275	.170	.160	92	42	64	29.025	29.067	29.046	29.046
10	44	60	49	51	.218	.177	.175	76	34	50	29.008	29.033	29.019	29.050
11	42	51	44	45⅔	.177	.173	.173	66	46	60	28.985	28.932	28.955	28.957
12	32	59	48	46⅓	.143	.216	.189	79	63	56	28.934	28.829	28.854	28.872
13	36	60	37	44⅓	.100	.310	.157	64	60	71	28.876	28.880	29.016	28.924
14	37	55	45	45⅔	.116	.144	.228	53	33	76	29.060	28.974	28.930	28.988
15	41	43	26	36⅔	.257	.278	.071	100	100	51	28.678	28.391	28.636	28.568
16	18	22	12	17⅓	.067	.052	.075	68	44	100	28.856	28.931	28.899	28.895
17	15	18	8	13⅔	.070	.098	.062	82	100	100	28.863	28.888	28.982	28.911
18	15	31	28	24⅔	.086	.155	.117	100	89	76	29.021	29.050	29.058	29.043
19	29	46	31	35⅓	.123	.238	.174	77	77	100	29.028	28.921	28.956	28.968
20	28	40	26	31⅓	.135	.160	.123	88	64	87	29.081	29.213	29.246	29.180
21	26	42	28	32	.123	.113	.117	87	42	76	29.284	29.304	29.247	29.278
22	27	47	36	36⅔	.139	.225	.129	88	70	61	29.342	29.248	29.194	29.261
23	29	40	30	33	.123	.248	.130	77	100	78	29.054	28.888	28.948	28.963
24	32	48	37	39	.162	.143	.157	89	43	71	29.061	29.066	29.136	29.087
25	34	49	43	42	.138	.223	.209	71	64	75	29.275	29.230	29.240	29.248
26	38	61	46	48⅓	.186	.089	.103	81	17	33	29.246	29.170	29.180	29.198
27	42	65	45	50⅔	.257	.111	.160	66	18	53	29.148	29.014	28.967	29.043
28	46	67	46	53	.115	.190	.115	69	29	69	28.958	28.872	28.948	28.926
29	39	47	42	42⅔	.195	.273	.222	82	85	82	28.882	28.511	28.915	28.769
30	32	47	39	39⅓	.162	.103	.152	89	47	63	29.026	28.987	29.025	29.012
Sums.	.....	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	.....	......	......	41°.11	.172	.206	.167	78	59	71	....	....	....	29.047
Average..................						.182			69		....			

THE MONTH OF APRIL, 1875.

CLOUDS.						WINDS.						OZONE.		REGISTERING THERMOM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and Melted Snow.	Depth of Snow.
100	Cu. St.	80	Cu.	100	Cu. St.	S	3	S W	3	S W	3	7	3	60	31	......	......	....	..
100	Cu. St.	100	Cu. St.	00	....	S W	2	S W	2	....	0	4	2	40	24	......	......	....	..
00	....	100	Cu. St.	90	Cu. St.	S W	2	S W	2	W	2	3	4	54	34	......	......	....	..
100	Cu. St.	30	Cir. Cu.	10	Cir.	W	2	N W	2	....	0	4	2	55	28	......	......	....	..
20	Cir. Cu.	10	Cir.	00	....	N E	2	S E	2	S E	3	3	6	56	33	......	......	....	..
40	Cir. St.	100	Haze.	00	....	S	2	S W	2	....	0	2	6	76	38	......	......	....	..
50	Cu. St.	00	....	00	....	E	2	S W	2	S	2	4	7	68	37	......	......	....	..
100	Haze.	100	Cu. St.	00	....	S	1	S	3	S W	2	1	9	80	44	......	......	....	..
60	Cu. St.	40	Cu.	00	....	S W	3	S W	4	S W	3	2	4	56	35	......	......	....	..
00	....	70	Cu. St.	100	Cu. St.	S W	1	S W	2	N W	2	2	2	67	38	......	......	....	..
100	Cu. St.	100	Cu. St.	100	Nim.	N E	2	N E	2	N W	2	2	2	56	25	......	......	....	..
10	Cir. Cu.	20	Cu.	100	Cu. St.	....	0	S E	2	S	2	4	6	64	32	......	......	....	..
100	Cu. St.	40	Cu.	20	Cir.	S W	2	S	3	....	0	3	1	61	24	......	......	....	..
00	....	20	Cu.	100	Cu. St.	....	0	S W	3	S W	2	5	5	60	36	Night	......	....	..
100	Nim.	100	Cu. St.	100	Cu. St.	S W	2	S W	4	N W	4	10	7	47	14	......	Night	.02	..
90	Cu. St.	100	Nim.	100	Nim.	N W	3	N W	2	N W	2	8	8	24	10	10 A. M.	......	....	..
100	Cu. St.	100	Nim.	30	Cir.	....	0	N	3	....	0	6	1	24	0	......	......	....	..
40	Cir. St.	80	Cir. St.	60	Cu. St.	....	0	S W	3	....	0	1	3	33	15	......	5 P. M.	.05	1
60	Cir. St.	100	Cu. St.	100	Cu. St.	....	0	N E	2	N E	1	4	7	48	26	......	......	....	..
00	....	00	....	00	....	N E	2	N E	2	....	0	5	3	44	18	......	......	....	..
00	....	00	....	00	....	N E	3	N E	3	N E	2	4	4	43	15	......	......	....	..
00	....	00	....	00	....	N E	1	N W	2	S W	2	3	2	50	21	......	......	....	..
60	Cir. St.	100	Cu. St.	00	....	S W	1	S W	3	....	0	5	3	52	24	8 A. M.	11 A. M.	.04	..
100	Cu. St.	60	Cu.	00	....	N W	2	N W	3	N	2	2	2	50	28	......	......	....	..
00	....	20	Cu.	00	....	N	2	E	2	S E	2	4	1	52	25	......	......	....	..
50	Cir. St.	10	Cir. St.	00	....	....	0	S W	2	....	0	3	2	63	26	......	......	....	..
00	....	00	....	00	....	E	2	N E	2	....	0	2	2	66	29	......	......	....	..
20	Cir. St.	70	Cu. St.	00	....	E	2	S W	3	....	0	4	1	70	39	......	......	....	..
100	Cu. St.	100	Nim.	00	....	N E	3	S W	3	W	1	3	8	49	30	5 A. M.	8 P. M.	.50	..
40	Cu.	60	Cu.	00	....	N W	3	S W	3	....	0	2	6	50	30	......	......	....	..
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	.61	1
52	....	57	....	27	....	....	..	....	..	....	..	3.73	3.96	53°.86	26°.96	......	......	....	..
		45																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air. 7 A. M.	2 P. M.	9 P. M.	Daily Mean.	Pressure of Vapor, in Inches. 7 A. M.	2 P. M.	9 P. M.	Relative Humidity, or Percentage of Saturation. 7 A. M.	2 P. M.	9 P. M.	Barometer Reduced to Freezing Point. 7 A. M.	2 P. M.	9 P. M.	Mean.
1	35	32	30	$32\frac{1}{3}$	.204	.181	.148	100	100	89	28.706	28.387	28.874	28.656
2	23	35	30	31	.135	.142	.148	88	70	89	28.916	29.006	29.026	28.949
3	33	53	45	$45\frac{1}{3}$	.186	.146	.117	81	36	39	29.048	28.998	28.935	29.027
4	40	56	43	$46\frac{1}{3}$	.182	.131	.278	73	39	100	28.969	28.953	28.937	28.933
5	48	46	39	$44\frac{1}{3}$	.120	.321	.195	36	100	82	28.909	28.904	28.902	28.905
6	39	56	45	$46\frac{2}{3}$	.131	.231	.182	55	51	61	29.013	29.011	29.010	29.011
7	45	57	53	$51\frac{2}{3}$	.228	.166	.219	76	36	54	29.011	28.890	28.687	28.863
8	70	78	60	$69\frac{1}{3}$	.551	.588	.456	75	62	88	28.610	28.398	28.593	28.534
9	55	54	47	52	.321	.308	.322	74	74	100	28.771	28.743	28.637	28.717
10	48	59	51	$52\frac{2}{3}$	.310	.439	.221	92	88	59	28.887	28.908	29.003	28.933
11	52	58	55	$58\frac{1}{3}$	.208	.483	.433	53	100	100	29.090	28.923	28.640	28.884
12	42	59	45	$48\frac{2}{3}$	.267	.216	.182	100	43	61	28.840	29.095	29.147	29.027
13	52	65	50	$55\frac{2}{3}$	.208	.509	.361	53	89	100	29.234	29.193	29.156	29.171
14	54	53	41	$49\frac{1}{3}$	.256	.216	.199	61	46	74	29.040	29.098	29.224	29.121
15	45	59	42	$48\frac{2}{3}$	.182	.190	.199	61	38	74	29.398	29.420	29.416	29.411
16	44	62	45	$50\frac{1}{3}$	.151	.370	.251	52	66	84	29.608	29.506	29.410	29.508
17	48	65	51	$54\frac{2}{3}$	.236	.483	.173	70	78	46	29.453	29.445	29.337	29.412
18	52	73	56	$60\frac{1}{3}$	.159	.376	.204	41	57	45	29.369	29.310	29.223	29.301
19	53	72	60	$61\frac{2}{3}$	.244	.296	.255	60	38	49	29.210	29.092	29.083	29.128
20	65	82	71	$72\frac{2}{3}$	.359	.390	.436	58	36	57	29.053	29.048	29.051	29.051
21	67	76	63	$68\frac{2}{3}$	.489	.505	.543	75	56	94	29.027	28.960	28.978	28.988
22	66	77	65	$69\frac{1}{3}$	.570	.492	.549	89	53	80	29.047	29.016	28.957	29.010
23	71	76	66	71	.537	.541	.536	71	60	84	28.983	29.010	28.937	28.980
24	62	79	63	68	.491	.537	.510	88	54	88	28.994	28.965	28.897	28.719
25	68	83	68	73	.509	.558	.543	75	50	79	28.937	28.954	28.962	28.951
26	57	80	57	$64\frac{2}{3}$	.268	.561	.268	58	55	58	29.167	29.158	29.138	29.154
27	60	86	72	$72\frac{2}{3}$	.283	.480	.706	54	39	90	29.188	29.117	29.072	29.126
28	69	86	66	$73\frac{2}{3}$	.398	.596	.604	56	47	94	29.098	28.996	28.967	29.020
29	54	68	52	58	.335	.349	.308	80	51	79	29.203	29.207	29.205	29.205
30	64	74	62	$66\frac{2}{3}$	.343	.641	.340	57	77	61	29.253	29.177	29.165	29.198
31	60	75	62	$65\frac{2}{3}$	.310	.287	.284	60	33	51	29.130	29.038	29.009	29.059
Sums	......	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	60°.82	.296	.378	.327	69	59	74	....	....	....	29.061
Average				....		.334			67		....			

THE MONTH OF MAY, 1875.

CLOUDS.						WINDS.						OZONE.		REGISTERING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Nim.	100	Nim.	100	Nim.	N E	2	N E	3	N W	3	4	8	50	24	6 A. M.	10 P. M.	.87	3
100	Cu. St.	70	Cir. Cu.	00	....	N W	4	S W	4	S W	1	6	5	39	26	......	......	....	..
20	Cir. St.	100	Cu. St.	100	Cu. St.	S W	2	N W	3	....	0	4	3	54	37	......	......	....	..
40	Cir. St.	50	Cu.	00	....	S W	2	S W	3	....	0	2	2	60	38	......	......	....	..
100	Cu. St.	100	Nim.	00	....	S W	3	S W	2	N W	2	8	6	48	31	8 A. M.	4 P. M.	.35	..
00	....	60	Cu. St.	00	....	N W	3	S W	3	....	0	2	7	49	39	......	......	....	..
100	Cu. St.	100	Cu. St.	00	....	S E	2	S E	3	S E	2	4	6	60	43	......	......	....	..
00	....	100	Cu. St.	00	....	S	3	S W	3	W	1	4	9	85	49	4 P. M.	7 P. M.	.68	..
70	Cu. St.	100	Nim.	100	Cu. St.	S W	1	S	1	S W	2	2	7	66	44	1 P. M.	7 P. M.	.52	..
50	Cu. St.	100	Cu. St.	00	....	S W	1	S W	3	....	0	3	3	64	39	......	......	....	..
100	Cu. St.	100	Cu. St.	100	Nim.	S E	2	S	2	S W	3	7	10	60	37	10 A. M.	10 P. M.	.63	..
100	Nim.	20	Cu.	00	....	N W	4	N W	4	N	1	4	1	63	35	......	......	....	..
10	Cu.	100	Cu. St.	100	Nim.	....	0	S E	2	....	0	2	7	69	46	6 P. M.	Night.	.35	..
100	Cu. St.	100	Cu. St.	10	Cir.	S E	1	N W	3	N W	2	3	4	59	36	......	......	....	..
20	Cir. St.	5	St.	10	Cu.	N W	2	N	2	N E	2	5	5	67	28	......	......	....	..
00	....	00	....	5	St.	....	0	N W	2	....	0	3	4	65	34	......	......	....	..
60	Cu. St.	80	Cir. St.	90	Cir. St.	....	0	W	3	....	0	2	1	70	36	......	......	....	..
10	Cir. St.	00	....	20	Cir.	....	0	....	0	....	0	3	1	76	44	......	......	....	..
70	Cir. St.	60	Cu. St.	20	Cu. St.	....	0	W	3	....	0	2	2	78	49	......	......	....	..
5	Cir.	00	....	00	....	S	3	S W	3	....	0	2	3	84	50	......	......	....	..
30	Cu. St.	100	Nim.	100	Cu. St.	S W	2	S W	2	....	0	1	1	78	51	2 P. M.	4 P. M.	.05	..
10	Cu. St.	100	Cu. St.	10	Cir.	....	0	S	1	....	0	1	1	84	50	......	......	....	..
20	Cir. St.	100	Cu. St.	100	Cu. St.	....	0	S W	3	....	0	1	4	79	53	......	......	....	..
100	Cu. St.	100	Cu. St.	10	Cu.	....	0	S W	1	....	0	2	2	82	56	......	......	....	..
00	....	50	Cu.	00	....	....	0	S W	1	....	0	3	2	89	49	......	......	....	..
100	Smoke.	00	....	00	....	E	2	E	2	....	0	2	1	83	41	......	......	....	..
00	....	00	....	00	....	....	0	S W	2	S E	1	4	6	87	46	......	......	....	..
100	Smoke.	100	Cu. St.	100	Nim.	....	0	S W	3	....	0	4	6	88	49	3 P. M.	5 P. M.	.01	..
40	Cu.	00	....	00	....	N W	3	N W	3	....	0	3	5	76	39	In Night	......	1.00	..
5	St.	10	Cir.	00	....	S E	1	S W	2	S W	1	5	2	79	52	......	......	....	..
5	Cir.	50	Cir.	00	....	S E	2	S W	2	....	0	1	1	78	54	......	......	....	..
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	4.46	3
47	....	63	....	31	....	....	..	....	..	....	..	3.19	4.03	68°.61	42°.09	......	......	....	..
		47																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air. 7. A. M.	2 P. M.	9 P. M.	Daily Mean.	Pressure of Vapor, in Inches. 7 A. M.	2 P. M.	9 P. M.	Relative Humidity, or Percentage of Saturation. 7 A. M.	2 P. M.	9 P. M.	Barometer Reduced to Freezing Point. 7 A. M.	2 P. M.	9 P. M.	Mean.
1	60	87	65	70⅔	.367	.492	.549	71	53	80	29.010	28.937	28.910	28.719
2	66	84	61	70⅓	.604	.262	.505	94	22	94	28.938	28.942	28.930	28.940
3	60	67	59	62	.328	.425	.439	65	64	88	29.138	29.192	29.175	29.168
4	57	84	65	68⅔	.407	.329	.389	87	28	63	29.170	29.184	29.077	29.144
5	63	74	69	68⅔	.510	.463	.635	88	56	90	29.167	29.090	29.216	29.158
6	60	68	58	62	.396	.319	.365	76	47	76	29.137	29.181	29.028	29.115
7	50	57	50	52⅓	.258	.322	.258	71	69	71	28.989	29.053	29.029	29.023
8	57	74	57	62⅔	.322	.463	.407	69	56	87	29.131	29.120	29.110	29.120
9	55	72	59	62	.349	.358	.390	81	46	76	29.139	29.122	29.057	29.106
10	59	72	69	66⅔	.410	.422	.599	82	54	85	29.067	29.079	29.019	29.055
11	72	85	66	74⅓	.595	.733	.639	76	61	100	29.006	28.989	29.129	28.979
12	59	63	45	55⅔	.410	.270	.228	82	47	76	28.998	29.134	29.129	29.087
13	50	63	53	55⅓	.234	.270	.321	65	47	80	29.337	29.285	29.179	29.267
14	47	72	54	57⅔	.298	.296	.335	92	38	80	29.190	29.084	29.071	29.115
15	58	74	60	64	.365	.396	.426	76	48	82	29.002	28.933	28.996	28.977
16	58	79	60	65⅔	.452	.362	.456	94	36	88	28.984	29.056	29.005	28.988
17	61	68	54	61	.473	.411	.418	88	60	100	28.988	28.993	29.088	29.023
18	51	74	54	59⅔	.374	.240	.335	100	28	80	29.143	29.190	29.191	29.175
19	55	82	61	66	.349	.322	.269	81	29	50	29.208	29.203	29.205	29.205
20	63	84	67	71⅓	.416	.397	.362	72	34	55	29.229	29.194	29.036	29.186
21	66	84	65	71⅔	.438	.704	.618	68	60	100	29.148	28.864	28.847	28.953
22	65	80	69	71⅓	.618	.638	.564	100	62	79	28.847	28.977	28.869	28.898
23	69	85	70	74⅔	.671	.733	.733	95	61	100	28.860	28.961	28.967	29.929
24	76	85	76	79	.772	.733	.772	86	61	86	28.949	28.947	28.959	28.952
25	67	85	70	74	.632	.733	.733	100	61	100	28.997	29.024	29.004	29.008
26	71	88	72	77	.682	.735	.631	90	56	81	29.010	28.953	28.958	28.974
27	74	76	72	74	.604	.731	.631	73	81	81	28.952	28.864	28.772	28.863
28	58	72	63	64⅓	.394	.631	.510	82	81	88	29.056	29.035	29.097	29.063
29	58	72	63	64⅓	.396	.524	.478	76	66	83	29.111	29.110	29.046	29.089
30	68	82	61	70⅓	.443	.390	.383	65	36	71	29.121	29.126	29.180	29.436
31	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sums.	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Means	-----	-----	-----	66°.57	.453	.470	.479	81	51	64	-----	-----	-----	29.029
Average				-----	.467			65			-----			

THE MONTH OF JUNE, 1875.

CLOUDS.						WINDS.						OZONE.		REGIST'RING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Cu. St.	60	Cir. St.	100	Nim.	....	0	....	0	S W	2	9	10	69	53	......	......	.....	---
90	Cu. St.	20	Cir.	100	Cu. St.	S W	2	S	1	S W	1	5	6	86	51	......	......	.....	---
00	....	00	....	100	Cu.	S W	2	S W	3	....	0	2	1	22	54	......	......	.....	---
00	....	40	Cir. St.	100	Cir. St.	....	0	....	0	....	0	7	3	70	56	In Night	......	.10	---
100	Cu. St.	100	Cu. St.	00	....	....	0	S W	1	....	0	2	1	85	47	......	......	.....	---
100	Cir. St.	100	Cir. St.	10	Cu. St.	S W	1	S W	1	....	0	1	2	74	46	......	......	.....	---
90	Cir. St.	90	Cu. St.	10	....	N E	1	N E	2	....	0	3	2	71	40	......	......	.....	---
00	....	60	Cu.	10	Cu. St.	....	0	S W	1	....	0	4	2	67	49	......	......	.....	---
100	Cir. St.	100	Cu. St.	90	Cu. St.	S E	1	S E	2	....	0	2	3	78	55	9 P. M.	10 P M	.01	---
80	Cir. Cu.	60	Cu.	00	....	S E	1	S E	1	....	0	3	2	70	63	......	......	.....	---
00	....	20	Cu.	100	Nim.	S W	2	S W	2	S W	1	1	7	85	57	6 P. M.	10 P M	.67	---
100	Cu. St.	10	Cu.	00	....	N E	1	N W	2	N E	1	2	1	89	33	......	......	.....	---
5	Cir. St.	60	Cir. St.	100	Cu. St.	N E	1	N W	1	....	0	3	1	66	38	......	......	.....	---
00	....	00	....	00	....	....	0	E	1	....	0	6	5	66	47	......	......	.....	---
90	Cu. St.	80	Cir. Cu.	100	Cu. St.	S E	1	S E	1	....	0	8	1	76	50	......	......	.....	---
100	Fog.	10	Cu.	10	Cir. St.	S W	1	S E	1	....	0	3	4	76	53	......	......	.....	---
100	St.	90	Cir. Cu.	100	Cu. St.	....	0	N	1	N W	1	5	2	83	44	......	......	.....	---
00	....	00	....	20	Cir. St.	....	0	N E	2	....	0	4	0	71	43	......	......	.....	---
10	St.	5	St.	00	....	S W	1	N W	1	....	0	5	2	78	45	......	......	.....	---
00	....	00	....	00	....	S E	1	E	1	S E	2	2	6	83	49	......	......	.....	---
20	Cir.	00	....	100	Cu. St.	S E	1	S E	2	....	0	6	7	87	61	In Night	......	.17	---
100	Cu. St.	90	Cir. Cu.	00	....	....	0	W	1	....	0	2	8	85	63	......	......	.....	---
100	Cu. St.	100	Cir. St.	00	....	W	1	S W	1	....	0	3	7	89	68	In Night	......	.18	---
90	Cir. St.	100	Nim.	00	....	S W	2	....	0	....	0	5	6	88	63	Showers.	......	.71	---
100	Cu. St.	100	Cu. St.	100	Cu. St.	....	0	....	0	....	0	1	1	86	68	......	......	.....	---
90	Cir. Cu.	20	Cu.	00	....	....	0	S W	1	....	0	6	1	89	59	......	......	.....	---
90	Cir. St.	100	Nim.	00	....	S E	1	S W	2	N W	2	9	8	84	59	......	......	.....	---
40	Cir. St.	80	Cu. St.	90	Cu. St.	N E	1	....	0	....	0	3	4	74	53	......	......	.....	---
90	Cir. St.	90	Cir. Cu.	0	....	N E	1	S W	1	....	0	5	6	78	58	......	......	.....	---
00	....	00	....	90	Cir. St.	S W	1	S W	2	....	0	2	1	84	56	......	......	.....	---
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	.....	---
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	1.84	---
59.5	....	53	....	44	....	....	..	....	..	....	..	3.96	3.66	79°.73	52°.70	......	......	.....	---
		52																	

67

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	63	73	59	65	.446	.545	.500	77	67	100	29.319	29.306	29.260	29.295
2	63	71	65	66⅓	.478	.572	.420	83	26	68	29.214	29.268	29.090	29.191
3	68	74	70	70⅔	.577	.680	.695	85	81	95	29.001	28.969	28.946	28.972
4	77	86	73	78⅔	.758	.677	.693	82	54	85	28.972	28.993	29.021	28.995
5	79	82	71	77⅓	.900	.809	.759	91	74	100	29.122	29.146	29.136	29.135
6	69	67	64	66⅔	.708	.556	.596	100	84	100	29.100	29.208	29.210	29.173
7	64	70	63	65⅔	.339	.586	.576	72	80	100	29.356	29.377	29.366	29.366
8	59	85	63	69	.500	.282	.510	100	23	88	29.397	29.337	29.360	29.365
9	65	82	64	70⅓	.516	.802	.529	84	72	89	29.221	29.147	29.075	29.148
10	71	86	64	73⅔	.608	.518	.343	80	42	57	28.986	28.951	29.002	28.979
11	61	75	65	67	.473	.382	.439	88	44	88	29.114	29.097	29.027	29.079
12	65	85	67	72⅓	.407	.420	.489	63	35	75	29.021	28.934	28.922	28.962
13	64	80	65	69⅔	.563	.561	.502	94	55	78	28.908	28.945	28.905	28.919
14	63	86	66	71⅔	.446	.443	.502	77	56	78	28.925	28.891	28.884	28.900
15	70	89	68	75⅔	.586	.678	.648	80	50	95	28.863	28.813	28.828	28.835
16	68	87	71	75⅓	.543	.623	.682	79	48	90	28.900	28.868	28.904	28.911
17	68	73	67	69⅓	.543	.617	.662	79	77	100	28.952	28.952	28.915	28.939
18	60	73	58	63⅔	.487	.429	.483	94	51	100	28.998	29.100	29.130	29.076
19	57	78	65	64⅔	.466	.409	.420	100	43	63	29.205	29.175	29.133	29.171
20	58	82	67	69	.423	.460	.522	88	42	79	29.124	29.049	29.007	29.060
21	63	83	68	71⅓	.510	.447	.612	88	40	90	29.048	29.049	29.012	29.036
22	68	80	70	72⅔	.577	.577	.482	85	66	66	28.931	28.879	28.892	28.901
23	58	75	60	64⅓	.452	.415	.487	94	48	94	29.028	29.047	29.073	29.049
24	55	82	68	68⅓	.405	.460	.509	94	42	75	29.129	29.119	29.115	29.121
25	73	83	74	76⅔	.617	.558	.641	77	50	77	29.123	29.081	29.069	29.058
26	73	85	65	74⅓	.635	.601	.389	90	57	63	29.113	29.134	29.149	29.132
27	61	71	59	63⅔	.473	.537	.500	88	71	100	29.241	29.185	29.108	29.177
28	59	77	64	66⅔	.469	.884	.563	94	95	94	29.107	29.045	29.000	29.051
29	61	81	63	69	.505	.585	.483	94	56	78	28.964	28.942	28.967	28.957
30	62	79	58	66⅓	.460	.501	.394	83	51	82	29.111	29.146	29.210	29.155
31	58	76	61	65	.394	.402	.354	82	45	66	29.241	29.200	29.276	29.259
Sums.	-----	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	-----	-----	------	69.°67	.525	.552	.528	86	63	85	--------	--------	--------	29.044
Average						.535			78		------------------------			

THE MONTH OF JULY, 1875.

CLOUDS.						WINDS.						OZONE.		REGISTERING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Cir. St.	100	Cu. St.	00	....	....	0	S W	4	....	0	1	2	75	57	......	......	....	..
100	Cu. St.	100	Cu. St.	40	Cu. St.	S E	1	S E	3	S E	1	4	8	74	60	......	......	....	..
90	Cir. St.	100	Nim.	20	Cu. St.	S E	1	S W	4	....	0	4	3	87	67	1:30 P. M.	3 P. M.	.02	..
90	Cir. Cu.	90	Cu.	00	....	S W	4	S W	4	S W	4	3	2	91	63	......	......	....	..
90	Cir. Cu.	60	Cu.	100	Nim.	N	1	S W	2	S E	3	1	3	87	64	In Night.	......	.18	..
100	Nim.	100	Cu. St.	10	Cu.	S W	1	N	2	....	0	2	2	73	57	7 A. M.	12 M.	.54	..
10	Cu.	40	Cu. St.	00	....	N W	2	N W	2	....	0	2	0	71	49	......	......	....	..
5	St.	90	Cir. Cu.	00	....	....	0	W	1	....	0	3	2	85	54	......	......	....	..
100	Cir. Cu.	00	....	00	....	....	0	N W	3	....	0	4	3	83	59	......	......	....	..
5	Cu.	10	Cu.	10	Cir. St.	N W	1	N W	3	N W	2	5	3	8[illegible]	44	......	......	....	..
40	Cir. St.	00	....	00	....	N E	1	S E	1	....	0	2	2	82	53	......	......	....	..
10	Cu.	00	....	60	Cir. St.	S E	1	S W	3	S W	1	4	8	88	59	In Night.	......	.33	..
100	Cu. St.	40	Cu.	50	Cir. St.	W	1	W	2	....	0	6	1	83	48	......	......	....	..
00	....	10	Cir.	10	Cu. St.	....	0	W	2	....	0	4	1	88	59	......	......	....	..
5	Cir.	80	Cir. Cu.	00	....	S W	1	S W	2	....	0	4	8	92	62	3 P. M.	5 P. M.	.63	..
00	....	10	Cir. St.	00	....	S W	1	N W	3	....	0	7	4	89	64	In Night.	......	.04	..
100	Cu. St.	100	Cu. St.	100	Cu. St.	N E	1	....	0	....	0	3	8	75	57	2:30 P. M.	Night.	.56	..
100	Cu. St.	10	Cu.	00	....	N E	1	N E	2	....	0	3	0	77	48	......	......	....	..
10	Cir. Cu.	10	Cu.	00	....	....	0	S W	4	....	0	4	5	80	48	......	......	....	..
00	....	00	....	00	....	....	0	S E	1	S W	1	4	2	87	56	......	......	....	..
100	Cu. St.	90	Cir. Cu.	100	Cu. St.	....	0	S W	1	....	0	1	4	85	61	......	......	....	..
90	Cir. St.	100	Cir. St.	100	Cu. St.	S W	1	S W	2	N E	1	5	5	82	49	......	......	....	..
00	....	90	Cir. Cu.	00	....	....	0	....	0	....	0	6	0	79	46	......	......	....	..
00	....	10	Cu.	00	....	S	1	S	1	....	0	6	8	86	54	......	......	....	..
10	Cir. St.	90	Cir. Cu.	100	Cu. St.	S W	1	S W	2	S W	1	3	6	86	63	......	......	....	..
40	Cir.	50	Cu.	00	....	S W	1	W	2	....	0	1	1	86	47	......	......	....	..
90	Cir.	100	Nim.	100	Cu. St.	....	0	....	0	....	0	2	1	76	50	12 M.	7 P. M.	.12	..
00	....	80	Cir. Cu.	00	....	....	0	S E	1	....	0	3	1	80	53	......	......	....	..
100	Cu. St.	40	Cu.	00	....	....	0	S W	1	....	0	4	1	85	52	......	......	....	..
100	Cir. St.	20	Cu.	00	....	N	1	....	0	....	0	3	4	81	47	......	......	....	..
100	Cir. St.	90	Cir. Cu.	100	Cu. St.	N E	2	N E	3	....	0	5	2	74	45	......	......	....	..
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	2.42	..
54	....	55	....	29	....	....	..	....	..	....	..	3.52	3.22	82°.38	54°.67	......	......	....	..
46																			

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	57	64	56	59	.350	.433	.336	75	73	75	29.200	29.195	29.198	29.198
2	56	69	63	62⅔	.336	.367	.446	75	32	77	29.185	29.141	29.167	29.164
3	61	69	55	61⅔	.442	.462	.405	83	65	94	29.149	29.131	29.158	29.146
4	56	68	62	62	.420	.543	.523	94	79	94	29.122	29.105	29.107	29.111
5	63	77	72	70⅔	.446	.758	.559	77	82	72	29.022	28.902	28.767	28.897
6	64	61	56	60⅓	.464	.442	.449	77	83	100	28.617	28.642	28.642	28.634
7	58	70	56	61⅓	.423	.586	.308	88	80	69	28.771	28.902	28.967	28.680
8	65	76	61	67⅓	.483	.402	.413	78	45	77	29.075	29.051	29.064	29.063
9	58	84	64	68⅔	.452	.433	.529	94	37	89	29.042	29.009	29.086	29.046
10	62	75	74	70⅓	.556	.519	.429	100	60	51	28.821	28.847	28.780	28.816
11	64	69	59	64	.529	.584	.439	89	79	88	28.697	28.784	28.826	28.769
12	60	78	58	65⅓	.456	.478	.452	88	50	94	28.882	28.887	28.926	28.898
13	61	79	61	67	.505	.501	.473	94	51	88	28.965	28.886	28.976	28.949
14	64	81	63	69⅓	.497	.438	.510	83	41	88	28.997	28.924	28.950	28.957
15	72	69	64	68⅓	.595	.599	.596	76	85	100	28.906	28.848	28.866	28.873
16	65	73	62	66⅔	.563	.442	.429	94	55	77	28.919	28.920	28.930	28.923
17	63	74	58	65	.510	.429	.452	88	51	94	28.942	28.946	28.952	28.947
18	56	72	61	63	.449	.455	.473	100	58	88	28.959	28.928	28.956	28.948
19	58	71	55	61⅓	.483	.469	.433	100	62	100	28.954	28.958	28.991	28.968
20	58	77	59	64⅔	.483	.389	.410	100	42	82	29.058	29.030	29.057	29.048
21	60	74	64	66	.487	.396	.529	94	48	89	29.089	29.223	29.286	29.199
22	50	62	47	53	.309	.340	.323	85	61	100	29.375	29.365	29.395	29.378
23	50	70	54	58	.361	.586	.418	100	80	100	29.423	29.386	29.344	29.384
24	48	74	53	58⅓	.335	.396	.375	100	48	93	29.399	29.358	29.358	29.372
25	56	77	53	62	.449	.389	.375	100	42	93	29.365	29.297	29.226	29.296
26	63	83	67	71	.543	.447	.522	94	40	79	29.241	29.214	29.206	29.220
27	65	87	70	74	.549	.467	.516	89	36	70	29.226	29.203	29.189	29.206
28	64	88	70	74	.529	.453	.516	89	34	70	29.187	29.145	29.120	29.151
29	68	77	64	69⅔	.543	.678	.563	79	73	94	29.147	29.142	29.132	29.140
30	60	85	61	68⅔	.518	.420	.473	100	35	88	29.171	29.121	29.087	29.126
31	64	90	76	76⅔	.563	.542	.614	94	38	68	29.126	29.087	29.094	29.102
Sums.	......	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	......	......	......	65°.48	.472	.478	.461	90	56	85	....	....	....	29.025
Average..................						.470			77		....			

THE MONTH OF AUGUST, 1875.

CLOUDS.						WINDS.						OZONE.		REGISTERING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 9 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning Rain, or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Nim.	100	Cu. St.	10	St.	N E	1	N E	2	N E	1	5	7	68	48	......	......	....	..
5	St.	100	Cu. St.	100	Cu. St.	N E	2	N E	2	N E	1	3	7	79	55	......	......	....	..
100	Cu. St.	95	Cu.	00	....	N	1	N E	2	....	0	4	1	76	47	......	......	....	..
90	Cir. Cu.	100	Nim.	100	Cu. St.	....	0	S W	1	....	0	7	3	74	55	......	......	....	..
00	....	90	Cu.	100	Cu. St.	S W	1	S E	3	S	2	7	4	85	62	Night.	......	....	..
100	Cu. St.	100	Cu. St.	100	Nim.	S W	2	S W	3	S W	3	8	8	67	54	......	......	....	..
100	Cu. St.	100	Cu. St.	00	....	N W	3	N W	3	....	0	4	6	75	43	......	12 M.	.15	..
00	....	90	Cu.	10	Cir.	W	1	N W	2	....	0	2	3	83	51	In Night.	......	.07	..
00	....	60	Cu.	50	Cir. St.	....	0	S W	1	....	0	4	6	87	57	2 P. M.	3 P. M.	.11	..
90	Cir. Cu.	90	Cir.	90	Cu. St.	....	0	S E	2	....	0	7	9	83	61	3 P. M.	......	....	..
90	Cu.	90	Cu.	00	....	S	1	S W	2	....	0	5	1	73	52	......	6 A. M.	.26	..
40	Cir. St.	80	Cu.	00	....	S W	3	S W	2	....	0	2	2	81	51	......	......	....	..
20	Cir.	80	Cu.	80	Cir. Cu.	....	0	S W	3	....	0	4	5	84	54	......	......	....	..
00	....	50	Cir. Cu.	0	....	....	0	S W	2	....	0	2	3	87	58	......	......	....	..
10	Cir.	90	Cir. St.	10	Cir. St.	S W	1	S W	2	....	0	4	0	86	57	11 A. M.	6 P. M.	.28	..
00	....	90	Cu.	10	Cir. St.	....	0	W	3	....	0	2	2	83	54	......	......	....	..
40	Cir.	90	Cu.	00	....	S W	1	S W	2	....	0	3	0	78	47	......	......	....	..
100	Fog.	90	Cu.	90	Cir. Cu.	N W	1	N E	2	....	0	2	5	77	55	......	......	....	..
100	Cir. St.	90	Cu.	5	Cu. St.	....	0	N W	2	....	0	2	6	75	46	Shower.	......	....	..
00	....	40	Cu.	20	Cir.	....	0	S W	2	....	0	3	4	82	55	......	......	....	..
80	Cir. St.	100	Nim.	00	....	....	0	....	0	....	0	2	3	74	39	10 A. M.	3 P. M.	.60	..
00	....	20	Cu.	00	....	N W	1	N E	2	....	0	3	2	68	35	......	......	....	..
00	....	00	....	00	....	....	0	S E	2	....	0	4	2	72	38	......	......	....	..
80	Cir.	10	Cir.	00	....	....	0	S E	2	....	0	1	3	78	42	......	......	....	..
100	Fog.	60	Cir. St.	00	....	....	0	S E	2	....	0	3	4	81	48	......	......	....	..
00	....	10	Cu.	00	....	S E	1	S W	2	S E	2	3	8	84	58	......	......	....	..
00	....	20	Cu.	60	....	S E	1	S	2	S	1	2	2	90	56	......	......	....	..
20	Cir.	40	Cu.	00	....	....	0	S W	2	S E	1	1	3	91	58	......	......	....	..
100	Nim.	100	Cu. St.	00	....	....	0	S W	2	....	0	3	1	83	50	......	......	....	..
200	Fog.	10	Cu.	00	....	....	0	S E	1	....	0	4	1	89	53	......	......	....	..
20	Cu.	30	Cu.	00	....	....	0	S W	1	S E	1	2	4	93	62	......	......	....	..
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	1.47	..
48	....	68	....	25	....	....	..	....	..	....	..	3.5	3.7	80°.19	51°.64	......	......	....	..
47												3.6							

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	67	89	74	76⅔	.591	.678	.839	89	50	100	29.154	29.117	29.123	29.131
2	70	90	73	77⅔	.658	.623	.655	90	44	81	29.139	29.070	29.005	29.071
3	74	85	68	75⅔	.680	.691	.476	81	57	69	28.872	28.714	28.767	28.785
4	64	77	62	67⅔	.464	.339	.429	77	42	77	28.890	29.042	29.027	28.986
5	70	81	82	77⅔	.482	.510	.524	66	48	66	29.004	28.996	28.995	28.998
6	60	79	62	67	.487	.657	.566	94	66	100	29.136	29.125	29.150	29.137
7	50	84	66	66⅔	.361	.507	.438	100	43	68	29.209	29.174	29.116	29.166
8	67	88	75	76⅔	.457	.650	.705	69	49	81	29.131	29.087	29.114	29.111
9	70	75	72	72⅓	.733	.772	.745	100	86	95	29.085	28.972	28.969	29.009
10	49	59	45	51	.348	.242	.251	100	48	84	29.224	29.395	29.405	29.341
11	42	68	54	54⅔	.244	.349	.335	91	51	80	29.443	29.340	29.285	29.356
12	55	76	55	62	.349	.402	.371	81	45	74	29.200	29.183	29.141	29.176
13	50	76	59	61⅔	.361	.402	.439	100	45	88	29.405	29.306	29.388	29.396
14	56	70	64	63⅓	.449	.416	.497	100	57	83	29.419	29.361	29.294	29.358
15	61	76	63	66⅔	.537	.541	.576	100	60	100	29.237	29.140	29.038	29.138
16	59	67	46	57⅓	.500	.522	.311	100	79	100	28.821	28.798	28.925	28.848
17	40	47	35	40⅔	.225	.225	.204	91	70	100	29.114	29.167	29.210	29.164
18	31	53	46	43⅓	.155	.219	.262	89	54	84	29.188	29.007	28.924	29.040
19	45	47	43	45	.275	.323	.278	92	100	100	28.724	28.664	28.694	28.694
20	42	53	40	45	.267	.205	.248	100	73	100	28.795	29.021	29.184	29.000
21	33	50	41	41⅓	.188	.162	.212	100	45	82	29.273	29.284	29.297	29.285
22	39	49	39	42⅓	.216	.199	.216	91	57	91	29.324	29.317	29.314	29.318
23	42	61	41	48	.199	.216	.235	74	40	91	29.365	29.366	29.300	29.344
24	41	68	49	52⅔	.235	.232	.272	91	34	78	29.312	29.225	29.193	29.243
25	49	61	42	50⅔	.348	.269	.199	100	50	74	29.113	29.049	29.102	29.088
26	32	63	50	48⅓	.181	.243	.245	100	42	65	29.103	28.992	28.998	29.031
27	46	76	53	58⅓	.286	.273	.348	92	30	86	28.950	28.897	28.944	28.930
28	51	66	50	55⅔	.296	.316	.309	79	49	85	29.109	29.118	29.122	29.349
29	53	79	56	62⅔	.375	.430	.363	93	43	81	29.950	28.742	28.712	28.801
30	44	53	42	46⅓	.241	.219	.244	84	54	91	28.796	28.813	28.816	28.842
31	.....	......	......	......	......	......	......	......	......	......	....	....	....	....
Sums	.....	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	.....	......	......	58°.50	.373	.400	.391	90	54	85	....	....	....	29.031
Average....................					.388			76			....			

THE MONTH OF SEPTEMBER, 1875.

CLOUDS.						WINDS.						OZONE.		REGISTERING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
50	Cir.	90	Cir.Cu.	00	....	S E	1	S W	3	....	0	3	0	92	65	......	......	....	--
60	Cir. St.	60	Cir. Cu.	90	Cir. St.	....	0	S W	2	....	0	2	3	94	69	......	......	....	--
100	Cu. St.	40	Cu.	00	....	S W	3	S W	3	S W	3	4	2	84	61	......	......	....	--
100	Cu. St.	10	Cu. St.	00	....	W	3	S W	3	....	0	2	1	79	50	......	......	....	--
80	Cir. St.	100	Cir. St.	20	Cir. St.	S W	1	S W	3	S W	1	2	½	83	49	......	......	....	--
00	....	00	....	00	....	....	0	N	4	N	1	1	0	84	43	Shower.	......	.02	--
00	....	80	Cir. St.	00	....	....	0	S W	2	....	0	3	3	87	49	......	......	....	--
10	St.	100	Cir. St.	100	Cu. St.	S W	2	S W	2	....	0	1	4	93	66	......	......	....	--
90	St.	100	Cu. St.	100	Cu. St.	S	1	S	1	....	0	4	7	78	48	In Night	......	1.78	--
50	Cu. St.	00	....	00	....	E	3	S	2	N E	1	7	6	62	33	......	......	....	--
10	Cir. St.	40	Cir.	60	Cir. St.	....	0	N E	2	....	0	4	8	69	33	......	......	....	--
80	Cir. St.	10	Cir.	00	....	S	1	W	1	....	0	3	4	78	42	......	......	....	--
00	....	10	Cu.	40	Cir. St.	....	0	S W	1	....	0	5	2	79	49	......	......	....	--
90	Cir. St.	100	Cir. St.	10	Cir. St.	....	0	....	0	....	0	6	2	75	55	......	......	....	--
100	Cir. St.	90	Cir.Cu.	90	Cir.Cu.	....	0	S W	1	....	0	2	0	78	57	Night.	......	....	--
100	Nim.	80	Cir.Cu.	100	Nim.	....	0	N W	2	N E	3	5	9	71	40	......	Night.	.67	--
100	Cu. St.	100	Cu. St.	00	....	N W	3	S W	2	....	0	7	0	51	26	......	......	....	--
10	Cu. St.	100	Cu. St.	90	Cu. St.	....	0	S E	1	....	0	6	1	59	30	......	......	....	--
100	Nim.	100	Nim.	40	Cu. St.	....	0	S	2	N W	2	7	5	53	39	6 A. M.	......	....	--
100	Cu. St.	40	Cu. St.	00	....	N W	3	S W	3	N W	2	6	0	56	31	......	7 P. M.	.34	--
10	Cir.	100	Cu. St.	100	Cu. St.	S W	2	....	0	....	0	6	2	52	32	......	......	....	--
100	Cu. St.	100	Cu. St.	00	....	....	0	S W	1	....	0	5	6	55	35	......	......	....	--
90	Cu.	20	Cu.	00	....	S W	1	S W	1	....	0	3	6	64	37	......	......	....	--
00	....	00	....	00	....	S W	1	S W	3	....	0	5	7	71	40	......	......	....	--
100	Nim.	20	Cu.	00	....	N W	2	N W	3	....	0	7	1	65	27	6 A. M.	9 A. M.	.13	--
00	....	100	Cu. St.	00	....	....	0	S W	3	....	0	3	6	68	42	......	......	....	--
30	Cir. St.	100	....	00	....	S W	2	S W	3	....	0	4	5	77	45	......	......	....	--
90	Cir. St.	50	Cir.Cu.	00	....	S W	2	E	1	E	1	3	5	68	45	......	......	....	--
50	Cir.Cu.	60	Cir.Cu.	100	Cu. St.	S E	2	S W	2	S W	3	7	8	80	42	.....	......	....	--
90	Cu.	100	Cu. St.	100	Cu. St.	W	2	N W	1	N W	1	6	7	57	33	......	......	....	--
....	....	....	....	....	....	....	--	....	--	....	--	....	....	......	......	......	......	....	--
....	....	....	....	....	....	....	--	....	--	....	--	....	....	......	......	......	......	2.89	--
60	....	60	....	34	....	....	--	....	--	....	--	4.30	3.08	70°.40	43°.76	......	......	....	--
51																			

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in Open Air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	36	50	38	41⅓	.191	.162	.229	90	45	100	28.877	28.923	29.039	28.946
2	38	57	44	46⅓	.229	.166	.173	100	36	60	29.187	29.260	29.273	29.240
3	48	66	50	54⅔	.236	.284	.283	70	51	78	29.270	29.102	29.079	29.150
4	51	56	47	51⅓	.348	.363	.323	93	81	100	29.050	29.062	29.092	29.068
5	45	48	43	45⅓	.300	.335	.278	100	100	100	29.133	29.128	29.100	29.120
6	48	45	41	44⅔	.335	.300	.235	100	100	91	28.783	28.745	29.026	28.851
7	41	54	49	48	.235	.282	.297	91	67	85	29.157	29.136	29.115	29.136
8	43	53	35	43⅔	.254	.170	.188	92	42	100	29.086	29.200	29.269	29.185
9	29	40	47	36⅔	.160	.225	.248	100	70	100	29.237	29.001	28.872	29.037
10	38	35	45	39⅓	.208	.160	.162	91	53	80	28.887	28.993	29.025	28.968
11	32	41	32	35	.181	.147	.106	100	57	58	29.157	29.220	29.347	29.239
12	29	42	27	32⅔	.123	.134	.147	77	50	100	29.474	29.467	29.459	29.466
13	28	49	35	37⅓	.117	.130	.142	76	37	70	29.457	29.347	29.230	29.345
14	37	58	47	47⅓	.157	.255	.323	71	53	100	29.055	28.893	28.817	28.922
15	43	41	33	39	.278	.212	.188	100	82	100	28.718	28.728	28.878	28.775
16	30	37	28	31⅔	.058	.136	.153	35	62	100	28.951	28.970	28.976	28.966
17	38	51	39	42⅔	.186	.270	.216	81	72	91	28.731	28.684	28.869	28.761
18	34	35	23	30⅔	.155	.142	.123	79	70	100	29.171	29.297	29.377	29.282
19	23	55	38	38⅔	.123	.193	.186	100	44	81	29.411	29.370	29.313	29.365
20	37	64	49	50	.157	.176	.199	71	29	57	29.250	29.159	29.095	29.168
21	47	71	47	55	.225	.296	.273	70	38	85	29.059	29.031	29.049	29.046
22	46	77	54	59	.262	.260	.308	84	28	74	29.068	29.029	28.990	29.009
23	47	76	48	57	.225	.183	.212	70	20	63	28.963	28.890	28.894	28.916
24	50	65	47	57⅓	.153	.301	.285	32	49	85	28.793	28.771	28.889	28.851
25	47	51	47	48⅓	.298	.216	.298	92	46	92	29.019	28.918	28.790	28.929
26	44	42	34	40	.241	.177	.196	84	66	100	28.688	28.664	28.653	28.668
27	33	36	29	32⅔	.168	.129	.160	89	61	100	28.843	29.011	29.093	28.982
28	37	54	50	47	.178	.231	.234	81	55	65	28.979	28.824	28.817	28.873
29	55	62	58	58⅓	.433	.556	.483	100	100	100	28.819	28.748	28.525	28.697
30	39	36	33	36	.216	.191	.168	91	90	89	28.469	28.748	28.857	28.691
31	31	32	30	31	.118	.143	.167	68	79	100	29.007	29.027	29.058	29.031
Sums.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Means	.....	.....	.....	42°.93	.209	.223	.225	83	59	87	.....	.....	.....	29.016
Average.....						.219			76		.....			

THE MONTH OF OCTOBER, 1875.

CLOUDS.						WINDS.						OZONE.		REGISTERING THERMOM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and Melted Snow.	Depth of Snow.
20	Cir. St.	20	Cu.	00	....	....	0	....	0	....	0	7	8	57	32	......	......	....	..
10	St.	20	Cu.	00	....	S W	1	S W	2	N W	2	7	6	60	37	......	......	....	..
20	Cir.	80	Cir. St.	00	....	S W	3	S W	2	....	0	5	8	69	48	......	......	....	..
90	Cu. St.	100	Cu. St.	100	Nim.	....	0	N E	2	N E	1	6	2	66	43	7 P. M.	......	....	..
100	Nim.	100	Nim.	100	Nim.	....	0	N E	1	N E	1	1	0	50	41	......	......	....	..
100	Nim.	100	Nim.	100	Cu. St.	N E	1	N W	3	N W	3	0	3	49	36	......	6 P. M.	3.15	..
00	....	100	Cu.	100	Cu. St.	S W	2	S W	2	N W	1	7	8	58	40	......	......	....	..
100	Cu.	60	Cu.	00	....	N W	3	N	3	....	0	7	1	55	25	......	......	....	..
100	Cir. St.	100	Nim.	100	Cu. St.	....	0	....	0	S	2	5	6	49	28	1 P. M.	8 P. M.	.25	..
80	Cir.	60	Cir. Cu.	100	Cu. St.	S W	2	N E	2	N W	1	6	8	50	29	......	......	....	..
100	Cu. St.	100	Cu. St.	10	Cir.	N W	2	N W	2	N W	1	7	9	42	20	Snow Sq'lls.	......	....	..
90	Cu. St.	80	Cu.	10	Cir. St.	....	0	N E	1	....	0	7	7	45	22	......	......	....	..
00	....	00	....	00	....	S W	1	S W	2	....	0	8	8	51	26	......	......	....	..
20	Cir. St.	90	Cir. St.	100	Nim.	S	2	S	3	S W	1	4	6	60	36	6 P. M.	......	....	..
100	Nim.	100	Cu. St.	100	Nim.	N W	1	W	2	N W	2	3	8	44	28	......	10 P. M.	.16	..
100	Cu. St.	100	Cu. St.	90	Cir. Cu.	N W	2	W	2	....	0	7	9	41	26	......	......	....	..
100	Nim.	100	Cu. St.	100	Cu. St.	S W	2	S W	3	S W	2	6	9	59	33	Shower.	......	.03	..
100	Cu. St.	100	Cu. St.	00	....	S W	2	N W	2	....	0	7	8	39	18	In Night.	......	.02	..
60	Cir. Cu.	10	Cir. St.	00	....	....	0	S W	2	S W	1	7	7	55	22	......	......	....	..
10	Cir. St.	10	Cir. St.	00	....	S W	1	S W	2	S W	1	3	5	65	36	......	......	....	..
20	Cir.	00	....	00	....	S W	1	S W	1	....	0	5	7	72	42	......	......	....	..
00	....	00	....	00	....	....	0	S W	2	S W	2	3	4	74	43	......	......	....	..
10	Cir.	40	Cir. St.	00	....	....	0	S W	1	....	0	2	3	77	44	......	......	....	..
60	Cir. Cu.	00	....	100	Cir. St.	S W	1	S W	3	N W	2	4	4	67	45	......	......	....	..
100	Cir. St.	100	Cu. St.	100	Cu. St.	....	0	E	1	N E	2	6	8	55	44	5 P. M.	7 P. M.	.10	..
100	Cu.	100	Nim.	100	Nim.	S W	3	S W	3	S W	3	7	8	46	31	Snow Sq'lls.	......	....	¼
100	Cu. St.	100	Cu. St.	50	Cu. St.	W	2	N W	3	....	0	8	6	37	27	12 M.	8 P. M.	.10	..
90	Cir. Cu.	90	Cir. St.	100	Cir.	S E	2	S E	1	....	0	5	2	59	36	......	......	....	..
100	Nim.	100	Nim.	100	Nim.	....	0	S W	1	S W	2	2	9	63	38	4 A. M.	......	....	..
100	Cu. St.	100	Nim.	100	Nim.	S W	3	S W	3	S W	3	5	8	40	29	......	......	....	..
100	Nim.	100	Cu. St.	100	Cu. St.	N W	3	N W	3	N W	3	6	8	33	28	......	12 M.	2.00	¼
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	5.81	½
67	....	70	....	57	....	....	..	....	..	....	..	5.3	6.2	54°.38	33°.22	......	......	....	..
		64																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in open air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	30	36	30	32	.167	.170	.167	100	80	100	29.009	28.921	29.006	28.979
2	21	38	33	30⅔	.113	.103	.150	100	45	80	29.171	29.187	29.125	29.161
3	32	34	32	32⅔	.181	.175	.162	100	89	89	29.024	28.934	28.942	28.966
4	21	43	27	30⅓	.167	.142	.147	100	51	100	29.013	29.008	29.059	29.026
5	27	44	27	32⅔	.147	.196	.147	100	68	100	29.101	29.112	29.128	29.114
6	24	47	28	33	.129	.179	.153	100	55	100	29.152	29.144	29.147	29.148
7	27	52	37	38⅔	.147	.183	.178	100	47	81	29.175	29.146	29.178	29.166
8	37	43	39	39⅔	.221	.209	.195	100	75	82	29.257	29.271	29.296	29.275
9	38	42	39	39⅔	.208	.222	.216	91	83	91	29.283	29.149	29.073	29.142
10	35	43	33	37	.204	.164	.188	100	59	100	28.937	29.068	29.007	29.004
11	36	53	40	43	.120	.244	.203	61	60	82	28.961	28.891	28.910	28.921
12	41	57	47	48⅓	.169	.268	.249	65	58	77	28.894	28.910	28.940	28.915
13	31	33	32	32	.174	.150	.162	100	80	89	29.087	29.079	29.961	29.376
14	33	40	34	35⅓	.168	.182	.155	89	73	79	28.762	28.770	28.753	28.762
15	33	40	36	36⅓	.188	.139	.129	100	56	61	28.587	28,591	28.787	28.655
16	31	28	23	27⅓	.174	.153	.123	100	100	100	28.780	28.948	29.140	28.956
17	19	32	24	25	.103	.143	.129	100	79	100	29.275	29.362	29.286	29.308
18	31	34	36	33⅔	.136	.155	.129	78	79	61	28.951	28.744	28.604	29.100
19	39	38	31	36	.173	.165	.174	73	72	100	28.781	28.901	28.985	28.889
20	26	45	33	34⅔	.141	.182	.188	100	61	100	29.023	29.054	29.046	29.041
21	26	26	15	22⅓	.123	.082	.086	87	53	100	29.350	29.350	29.555	29.418
22	3	31	33	22⅓	.050	.174	.188	100	100	100	29.591	29.433	29.227	29.417
23	37	43	28	36	.178	.121	.153	81	43	100	29.017	29.010	29.248	29.092
24	24	30	18	24	.129	.093	.098	100	56	100	29.472	29.521	29.403	29.465
25	20	33	41	31⅓	.106	.168	.169	100	89	65	29.363	29.181	29.030	29.191
26	40	35	32	35⅔	.248	.183	.181	100	90	100	28.813	28.957	29.170	28.980
27	24	28	28	26⅔	.129	.117	.135	100	76	88	29.396	29.371	29.137	29.301
28	32	34	34	33⅓	.181	.196	.196	100	100	100	29.011	28.984	29.133	29.044
29	4	7	2	4⅓	.052	.060	.048	100	100	100	29.471	29.543	29.511	29.508
30	6	18	21	15	.057	.082	.096	100	84	85	29.411	29.251	29.194	29.285
......	.....	......	......	......	......	......	......	......	......	......	....	....	....	....
Sums.	.....	......	......	......	......	......	......	......	......	......	....	....	....	....
Means	.....	......	......	32°.96	.150	.160	.156	92	72	90	....	....	....	29.054
Average	....				.155			84			....			

THE MONTH OF NOVEMBER, 1875.

CLOUDS.						WINDS.						OZONE.		REGIST'RING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Cu. St.	90	Cir. Cu	00	....	....	0	....	0	....	0	5	7	37	18	......	......	....	....
00	....	80	Cir. St.	100	Cir. St.	....	0	S E	2	N E	2	6	8	39	21	In Night	......	.23	½
100	Cu. St.	100	Cu. St.	100	Cu. St.	N E	2	E	2	N W	2	6	9	35	29	......	......	....	....
90	Cir. Cu.	00	....	00	....	N	2	S W	2	....	0	5	8	44	22	......	......	....	....
100	Cu. St.	80	Cu.	00	....	....	0	S W	2	....	0	7	5	45	20	......	......	....	....
10	Cir.	100	Cir. St.	00	....	....	0	S W	2	....	0	5	4	51	20	......	......	....	....
00	....	00	....	00	....	....	0	E	2	N W	1	4	9	52	22	......	......	....	....
100	Cu. St.	100	Cu. St.	100	Cu. St.	....	0	E	2	....	0	6	7	44	34	......	......	....	....
100	Cu. St.	100	Cu. St.	100	Cu. St.	....	0	N E	2	N E	2	7	5	43	32	In Night	......	.28	....
100	Cu. St.	10	Cu.	90	Cir. St.	W	3	N W	3	....	0	4	6	45	28	......	......	....	....
10	Cir. St.	20	Cu.	30	Cir. St.	S W	2	S	3	S	2	7	6	57	36	......	......	....	....
90	Cir. St.	00	....	100	Cu. St.	S W	2	S W	2	....	0	2	7	60	29	Night	......	....	....
100	Nim.	100	Cu. St.	100	Cu. St.	N E	2	N E	2	N E	3	8	8	34	28	......	8 A. M.	.15	1
100	Cu. St.	100	Cir. St.	100	Cu. St.	N E	2	N E	2	S E	2	6	10	41	29	Night	......	....	....
100	Nim.	100	Cu. St.	100	Cu. St.	S W	2	S W	3	S W	2	6	8	40	30	......	9 A. M.	.15	1
100	Nim.	100	Nim.	10	Cir.	S W	2	S W	4	S W	3	4	5	32	10	......	......	....	....
00	....	90	Cir. St.	10	Cir. St.	....	0	S W	2	W	2	5	6	37	16	......	......	....	....
100	Cu. St.	100	Cu. St.	20	Cu. St.	....	0	S	3	W	2	3	3	42	29	......	......	....	....
100	Cu. St.	100	Cu. St.	00	....	N W	2	S W	2	....	0	4	4	40	23	......	......	....	....
100	Cu. St.	30	Cir. St.	00	....	....	0	S W	2	....	0	3	7	46	22	......	......	....	....
30	Cu.	20	Cu. St.	00	....	N W	3	W	2	....	0	2	6	26	3	......	......	....	....
100	Cu. St.	20	Cir.	100	Cu. St.	....	0	S E	3	S E	3	4	3	34	3	......	......	....	....
100	Cu. St.	100	Cu. St.	90	Cu. St.	....	0	S	3	W	3	5	4	45	24	......	......	....	....
100	Cu. St.	20	Cu.	00	....	S W	3	S W	3	....	0	5	2	36	12	......	......	....	....
90	Cir. St.	30	Cir.	100	Cu. St.	....	0	S	3	S E	3	4	9	41	18	Night	......	....	....
100	Cu. St.	100	Cu. St.	100	Cu. St.	....	0	W	3	N W	2	7	8	42	30	......	......	....	....
100	Cu. St.	100	Cu. St.	90	Cu. St.	N W	2	N E	2	S E	2	4	10	32	20	......	Night	.30	....
100	Nim.	100	Cu. St.	100	Cu. St.	S	2	S W	3	S W	2	3	2	36	10	......	......	....	....
100	....	100	Cu. St.	00	....	N	2	N	2	....	0	6	4	8	2	......	......	....	....
100	Cu. St.	100	Nim.	100	Cu. St.	E	1	S E	2	....	0	5	8	23	3	......	......	....	....
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	....	....
....	....	....	....	....	....	....	..	....	..	....	..	....	....	......	......	......	......	1.11	2½
77	....	70	....	55	....	....	..	....	..	....	..	4.9	6.6	39°.60	20°.80	......	......	....	....
		67																	

METEOROLOGICAL OBSERVATIONS FOR

Day of Month.	Thermometer in Open Air.				Pressure of Vapor, in Inches.			Relative Humidity, or Percentage of Saturation.			Barometer Reduced to Freezing Point.			
	7. A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	20	31	28	36⅓	.091	.174	.153	85	100	100	29.131	29.168	29.217	29.172
2	26	33	26	28⅓	.141	.168	.141	100	89	100	29.291	29.307	29.310	29.302
3	20	43	28	30⅓	.108	.142	.153	100	51	100	29.308	29.244	29.255	29.269
4	37	41	37	38⅓	.157	.235	.221	71	91	100	29.213	29.076	28.981	29.090
5	37	38	35	36⅔	.221	.229	.204	100	100	100	28.781	28.685	28.657	28.707
6	35	37	35	35⅔	.204	.221	.221	100	100	100	28.697	28.630	28.589	28.672
7	35	36	34	35	.204	.212	.196	100	100	100	28.550	28.493	28.483	28.512
8	32	35	31	32⅔	.181	.204	.155	100	100	89	28.571	28.687	28.751	28.669
9	26	29	29	28	.141	.142	.142	100	88	88	28.851	28.921	29.021	28.931
10	28	30	29	29	.153	.148	.160	100	89	100	29.081	29.048	28.943	29.024
11	32	31	28	30⅓	.181	.155	.153	100	89	100	28.706	28.730	28.820	28.752
12	23	30	34	29	.123	.130	.196	100	78	100	28.850	28.581	28.393	28.608
13	29	28	26	27⅓	.160	.117	.141	100	76	100	28.568	28.640	28.720	28.642
14	15	21	22	19⅓	.086	.113	.118	100	100	100	28.950	29.000	28.930	28.960
15	28	39	31	33	.153	.131	.174	100	55	100	28.476	28.433	28.704	28.571
16	27	23	17	22⅓	.111	.123	.094	75	100	100	28.766	28.691	28.711	28.722
17	6	13	4	7⅔	.057	.033	.032	100	43	100	29.076	29.045	29.098	29.073
18	5	11	8	8	.055	.071	.062	100	100	100	29.056	28.977	29.114	29.049
19	9	14	15	12⅔	.051	.067	.070	77	81	82	29.314	29.308	29.208	29.276
20	26	47	47	40	.123	.202	.225	87	62	70	29.083	29.045	29.062	29.063
21	50	49	43	47⅓	.283	.348	.278	78	100	100	29.002	28.950	28.979	28.977
22	43	54	48	48⅓	.278	.231	.212	100	55	63	28.977	28.800	28.752	28.843
23	44	47	32	41	.241	.179	.162	84	55	89	28.777	28.988	29.089	28.951
24	30	36	48	39⅓	.148	.212	.335	89	100	100	28.886	28.385	28.386	28.552
25	33	32	28	31	.188	.125	.153	100	69	100	28.717	28.988	29.071	28.925
26	30	34	31	31⅔	.167	.196	.155	100	100	89	28.699	28.489	28.856	28.681
27	13	26	22	20⅓	.078	.105	.118	100	75	100	29.385	29.463	29.352	29.400
28	25	34	24	27⅔	.135	.175	.129	100	89	100	29.335	29.189	29.161	29.228
29	27	38	37	34	.147	.165	.221	100	72	100	29.104	28.981	28.831	28.972
30	44	48	52	48	.289	.285	.361	100	85	93	28.987	29.042	29.059	29.029
31	56	69	54	59⅔	.363	.462	.418	81	65	100	29.039	29.004	29.017	29.020
Sums	.....	......	......	......	......	......	......	......	......	......	....	---+---	....	....
Means	.....	......	......	31°.58	.161	.177	.179	94	82	95	....	....	....	28.955
Average					.172			90			....			

THE MONTH OF DECEMBER, 1875.

CLOUDS.						WINDS.						OZONE.		REGIST'RING THERM'R.		RAIN AND SNOW.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.									
Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Per Cent of Cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Day: 7 A. M. to 2 P. M.	Night: 9 P. M. to 7 A. M.	Maximum.	Minimum.	Beginning, Rain or Snow.	Ending, Rain or Snow.	Inches of Rain and melted Snow.	Depth of Snow.
100	Cu. St.	100	Cu. St.	100	Cu. St.	----	0	----	0	S E	1	5	8	34	19	Snow Sq'ls.	------	-----	----
100	Cu. St.	10	Cir.	00	-------	S E	2	S E	2	----	0	6	7	36	16	------	------	-----	----
10	St.	10	St.	00	-------	----	0	----	0	----	0	4	6	45	17	------	------	-----	----
100	St.	100	Cu. St.	100	Cu. St.	----	0	S	1	----	0	7	6	43	30	Night	------	-----	----
100	Nim.	100	Nim.	100	Nim.	----	0	----	0	S	1	4	5	40	33	------	------	.52	----
100	Cu. St.	100	Nim.	100	Nim.	----	0	----	0	S W	1	3	4	37	33	------	------	-----	----
100	Nim.	100	Nim.	100	Nim.	----	0	E	2	----	0	2	6	38	32	------	------	.3	----
100	Nim.	100	Cu. St.	90	Cu. St.	N	2	N E	1	----	0	5	9	36	24	------	2 P. M.	-----	----
100	Cu. St.	100	Cu. St.	100	Cu. St.	S W	2	S W	2	----	0	5	7	30	23	------	------	-----	----
100	Cu. St.	100	Cu. St.	100	Nim.	S W	1	S W	2	S	2	6	9	32	26	Night	------	-----	----
100	Cu. St.	100	Nim.	100	Cu. St.	S E	1	N W	2	N W	3	4	7	32	14	------	7 P. M.	.21	2
100	Cu. St.	10	Cu.	00	-------	S W	1	S W	3	S W	3	3	8	36	22	------	------	-----	----
100	Cu. St.	90	Cu. St.	100	Cu. St.	S W	3	S W	4	N W	3	2	4	32	12	------	------	-----	----
100	Cu. St.	100	Cu. St.	100	Cu. St.	S W	3	W	3	----	0	5	8	39	14	Night	------	-----	----
100	Nim.	100	Cu. St.	30	Cir. St.	S W	3	W	4	----	0	5	5	40	25	------	8 A. M.	.10	1⅓
100	Cu. St.	100	Nim.	100	Nim.	S W	2	S W	3	S W	3	6	8	30	4	2 P. M.	------	-----	----
30	Cu.	10	Cir.	00	-------	S W	3	S W	3	S W	2	4	6	13	-1	------	------	-----	----
100	Nim.	100	Nim.	00	-------	S W	3	S W	3	S W	2	3	7	13	5	------	6 P. M.	.10	1
100	St.	90	Cir. St.	00	-------	----	0	S W	2	S E	3	6	8	18	7	------	------	-----	----
90	Cu. St.	90	Cu. St.	100	Cu. St.	S	3	S W	3	S W	3	5	8	50	24	------	------	-----	----
100	Cu. St.	100	Nim.	00	-------	S	3	S W	3	----	0	6	7	52	32	8 A. M.	6 P. M.	.43	----
00	--------	00	--------	00	-------	----	0	S W	3	S W	3	4	6	56	32	------	------	-----	----
10	Cir. St.	30	Cu.	00	-------	S W	3	W	3	N W	3	6	6	50	27	------	------	-----	----
100	Cu. St.	100	Nim.	100	Cu. St.	E	2	S E	2	S W	3	8	9	49	29	9 A. M.	8 P. M.	.28	----
100	Cu. St.	70	Cir. St.	100	Cu. St.	W	4	S W	4	----	0	4	8	33	37	Night	4 P. M.	.63	2
100	Nim.	100	Nim.	100	Cu. St.	E	2	----	0	W	4	9	9	36	11	------	------	-----	----
70	St.	70	Cu. St.	20	Cu.	----	0	----	0	S E	2	6	7	28	11	------	------	-----	----
95	St.	100	Cu. St.	00	-------	S E	2	S W	1	----	0	6	5	37	19	------	------	-----	----
30	St.	100	Cu. St.	100	Nim.	E	2	E	2	S	3	7	6	48	25	------	------	-----	----
100	Cu. St.	100	Cu. St.	00	-------	S W	2	S	3	S	3	6	5	60	42	------	------	-----	----
40	Cir. Cu.	90	Cu.	100	Nim.	S	3	S W	3	----	0	5	3	70	42	4 P. M.	12 M.	.24	----
----	--------	----	--------	----	-------	----	--	----	--	----	--	----	----	------	-----	------	------	2.80	6⅓
83	--------	82	--------	61	-------	----	--	----	--	----	--	5.	6.7	38°.45	22°.09	------	------	-----	----
75																			

ABSTRACT

OF METEOROLOGICAL OBSERVATIONS FOR 1875.

* Mean height of barometer (at 32° F.) in inches	28.998
Mean temperature in open air	43°.06
Mean maximum temperature	54°.60
Mean minimum temperature	29°.58
Range of temperature during the year	127°
Percentage of cloudiness	56
Relative humidity	79
Rain and melted snow in inches	28.237
Depth of snow fall, in inches	63¼
Ozone—Day observation	4.53
" Night observation	5.04

* The barometric pressure was measured by Pike's Barometer till the close of 1874. By comparison with Green's Standard Barometer this was found to give an error of .12 inch too low. This sum should be added to the observations prior to 1875 to give correct results.

INDEX.